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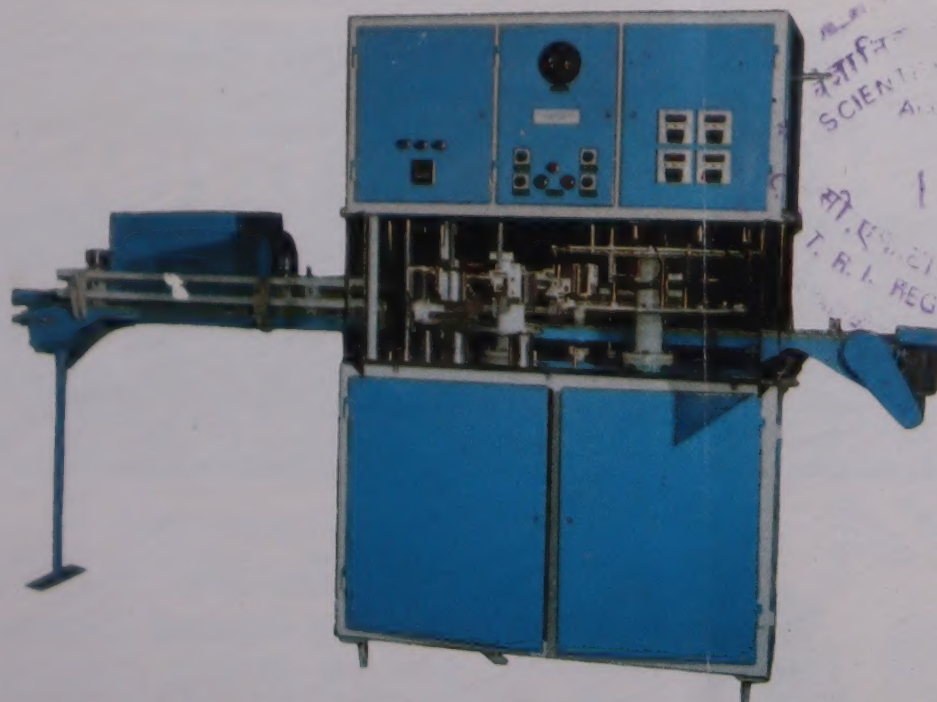
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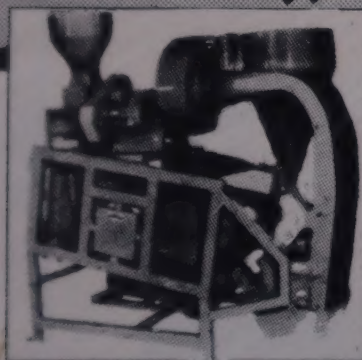
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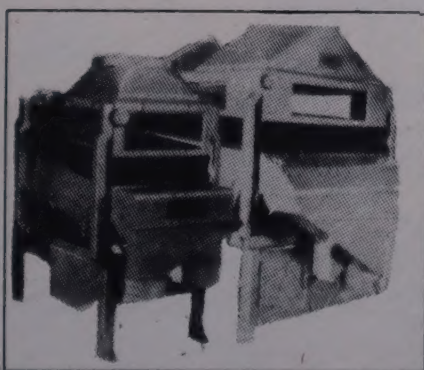
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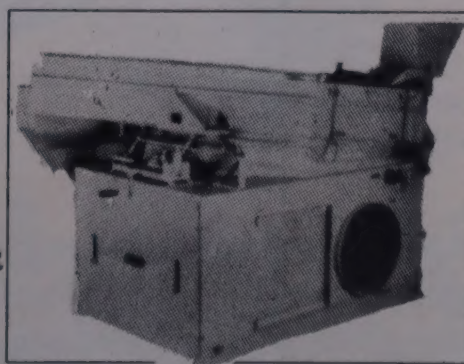


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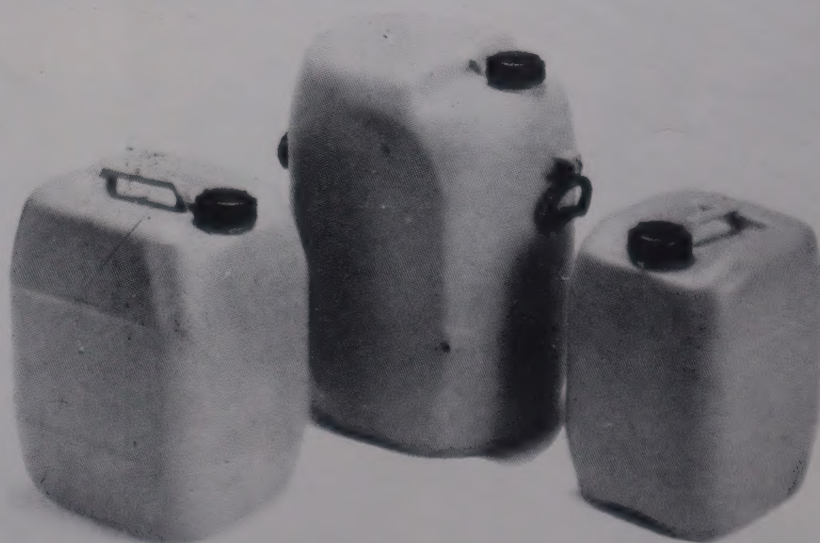


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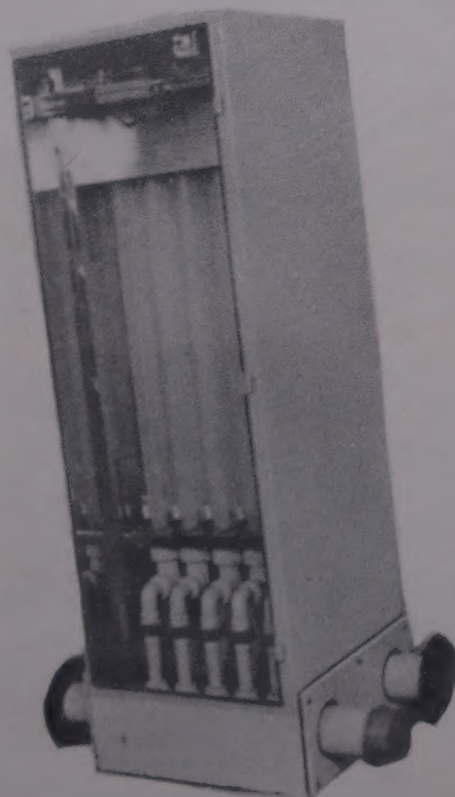
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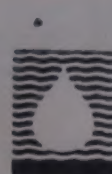
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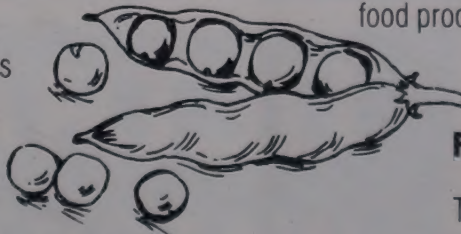
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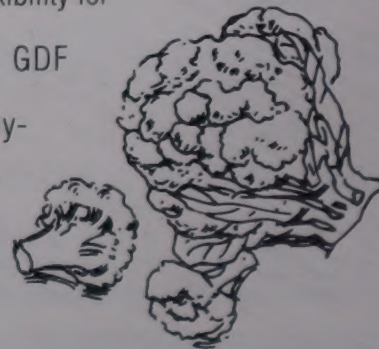


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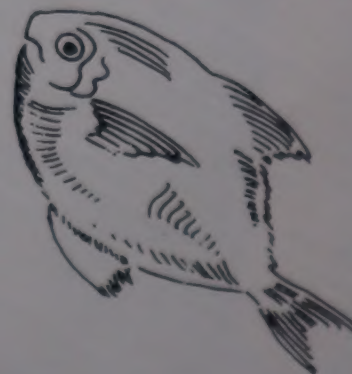
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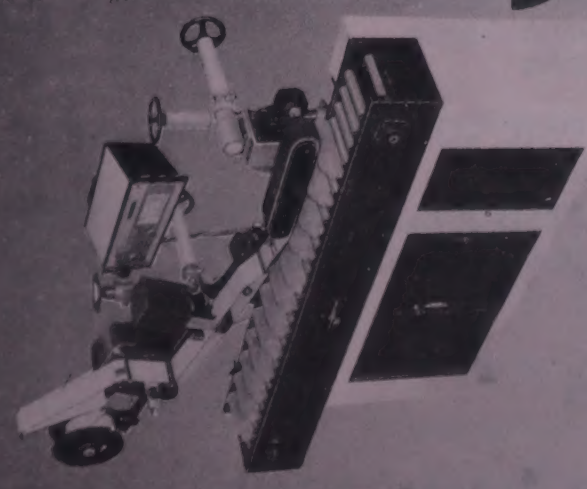
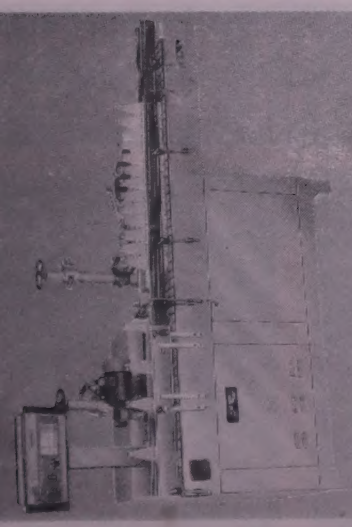
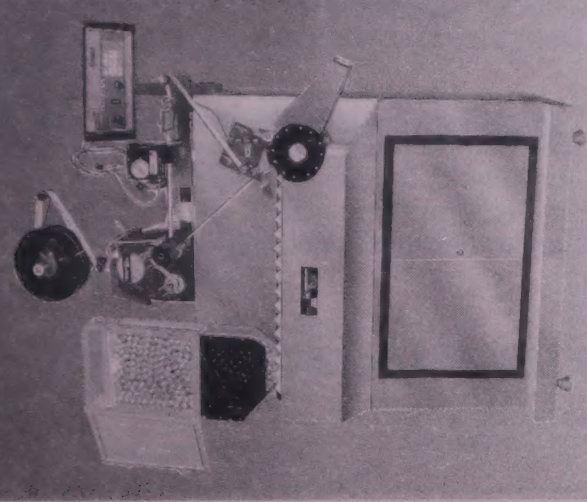
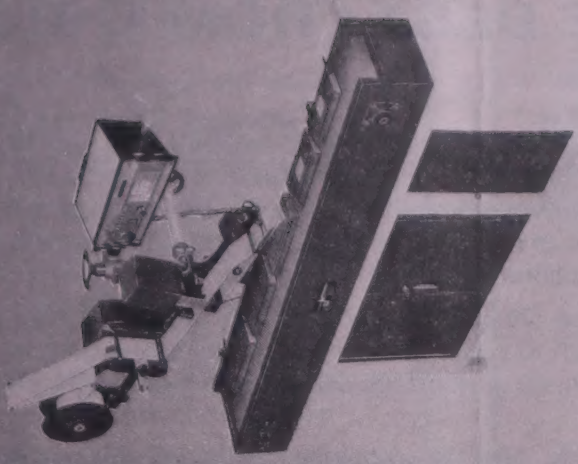
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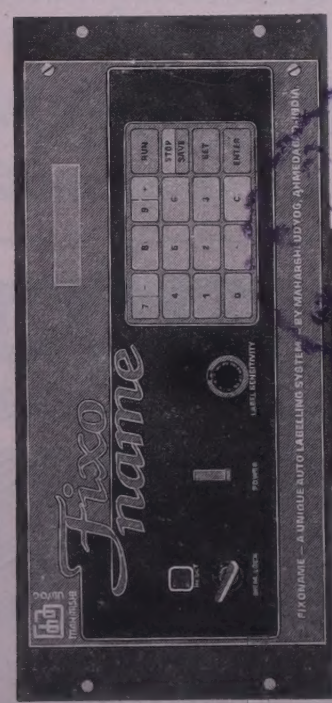
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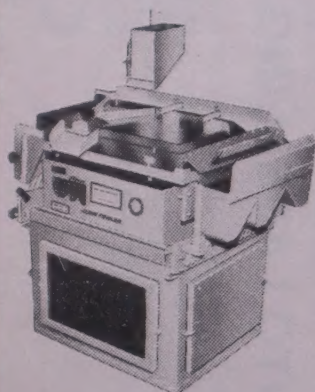
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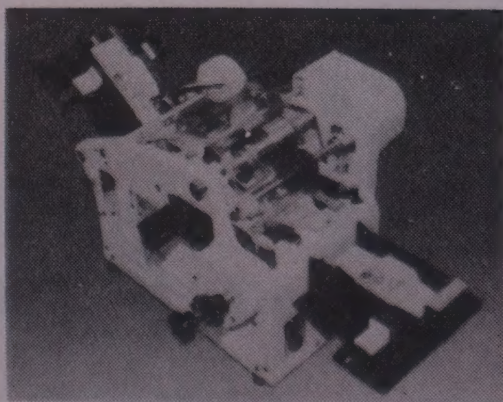
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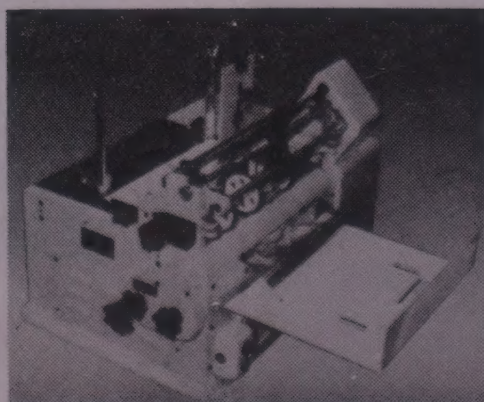
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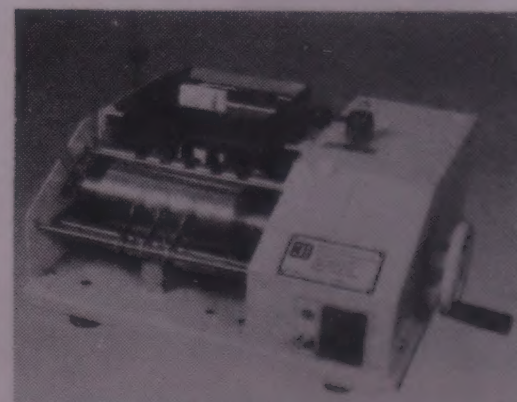
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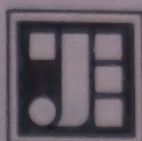
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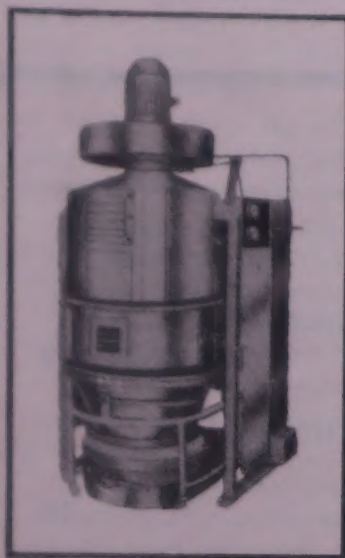
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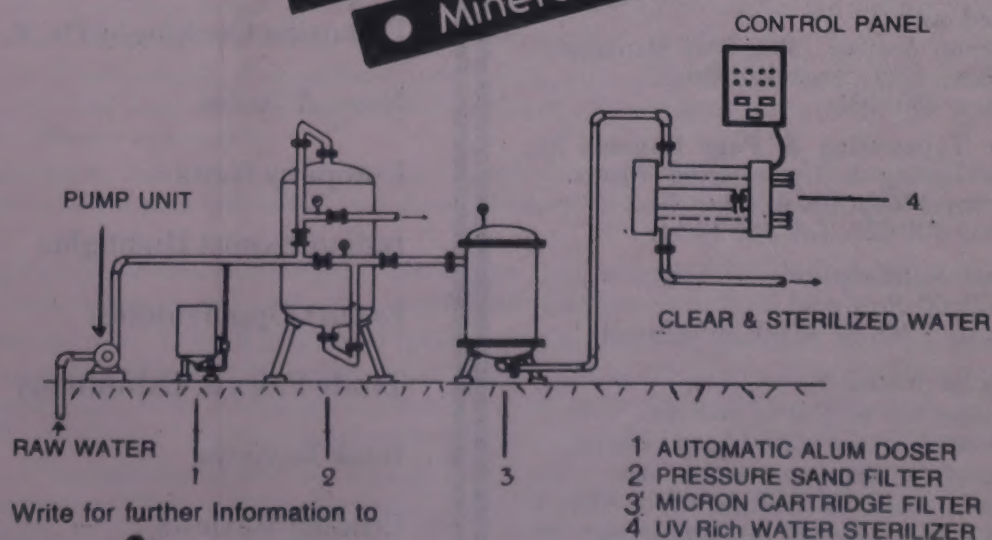
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Possibilities & Prospects for Food Processing Industry

India is the world's second largest producer of fruits and vegetables. Its tropical-to-temperate climate makes the country a biological wonder land, from succulent mangoes to luscious lychees, there is no fruit in the horticultural exotica that doesn't proliferate here. The Indian industry has a huge international target to aim at: a \$-1000-billion-dollar world trade and a tantalising West Asian market, ripe for the plucking.

Domestic advantage

The domestic market is taking on a razor-sharp competitive edge with the yuppie family turning increasingly to canned food. In response to the new gastronomical cravings, Indian marketers have unleashed a tidal wave of packaged foods in the last ten years led by I-SL's super-selling Maggie two-minute noodles. And, under the stimulus of reform, a sumptuous Rs. 1,260 crore in foreign investment has gushed into the country.

But why should a strong domestic market boost exports? Indeed, doesn't the presence of a huge home market likely to have just the contrary wet-blanket effect - weaken the motivation for companies to export? That, however, is not the way it works. Says Muktesh Pant, Executive Director, Exports, at Pepsi Foods Limited: "A strong home base gives us a cushion to fall back on in case things go wrong in the foreign markets which are influenced by a host of factors - government policy, tariff barriers etc - over which we have no control." The safely netting apart, a vibrant domestic market, proves to be a good training ground where companies can innovate on their products and wargame their strategies, for the tougher battles overseas.

Apart from the abundant natural resources, the country's staggering bio-diversity and the flourishing home market, should prove a major asset to export-minded firms. The question is: Will these natural advantages, including low labour costs, be enough in the face of man-made obstacles for the country to make a global impact?

A look at the performance of the industry thus far shows that it may not be enough. Of the 80 million tonnes (MT) of fruits and vegetables the country produces every year, only half-a-per cent goes into processing while a shocking 30 per cent of that wealth goes to seed because of infrastructural inadequacies: poor transport and storage facilities. Finally, with last year's exports totaling a measly \$ 60 million, India's share of the multi-billion-dollar global trade is a miniscule 0.06 per cent.

So what are the constraints holding India back?

To start with, there is a tax-regulatory structure riddled with contradictions and infrastructural pitfalls, making Indian exports uncompetitive on both the price and quality fronts. The Rao ministry has taken may a bold initiative in the last few years to make the taxes more industry-friendly. As a result of those overtures, many items critical to food processing have come off the tax list and others have become more tax-easy. But, despite the clean-up, several incongruities have escaped the reform broom and the now littering the country's image.

Products in the same category are, for example, treated partially for tax purposes: Butter, cheese and guar-gum-based products are off the tax hook; but that concession doesn't even extend to their brethren in the same category like extruded snacks and ice cream. Not to speak of products in another segment like cocoa and chocolate which continue to be overloaded with taxes.

Or, take hardware, for example: Certain kinds of equipment and machinery parts made in India are subject to excise and ST; but the same, when imported, are exempt from both. Also, considering the direct cost-push impact of duty on machinery on the price tag of the final product (a ten per cent duty hike effects the price by 3-5 per cent), there is a clear need to lower it to the minimum and, at any rate, to not more than 25 per cent.

But even more than process equipment which according to Pant, are relatively inexpensive, and easy to import, it is farm equipment that poses the real headache. Says Pant: "In Punjab most farmers use low horsepower tractors sold cheap by government. Prolonged use of such tractors has rendered the soil unfit for the cultivation of any plant with a root structure in excess of 50 cms. The way out is the use of powerful tractors which are not available in the country. But thanks to the duty structure, just one imported tractor has cost us Rs one crore." At least, export-oriented companies deserve a better deal.

Besides, there are logistic bottlenecks. Ferrying merchandise from the production site to one of the international ports can, for instance, prove to be an unnerving experience. Moving cargo from Punjab to the Bombay port, for example, involves sending empty cases from Delhi to Punjab and getting the packed boxes back to Delhi for customs clearance before finally dispatching them to Bombay. All because there are no customs clearing facilities at the production point.

If the logistic and tax structure are purged of such remaining irritants, Indian companies will be well-placed to gain global parity at least on the price front.

Quality frontier

And that will be half the battle won. The other half will have to be waged along the more daunting quality front. To break through the tough ready-to-eat food market, Indian companies will have to pander to the palate of consumers who are arguably the most discriminating and difficult to please, of any product category. And to attain those demanding standards, the domestic industry will need all the support it can get.

As a starter, it will need assured and abundant supply of raw materials of international standards. Stringent standards can be met only with extensive hi-tech farming. And that, in turn, will call for a system that facilitates corporate farming: A system that promotes a synergetic partnership between the corporates and the farmers, helping both grow faster and gain international acceptability.

The advantage of such a grower-processor partnership will be manifold: The companies will bring to farming, the technology, the capital and the marketing muscle necessary to penetrate the export market; the farmers will get a hefty stake in the companies in return for their land and together they could fuel the country's export drive.

The prevailing land ceiling laws are, however, weighted against corporate ownership of farmlands. True, companies like Pepsi and ITC have found a way around the law by striking up contracts with farmers; but it is still not possible for corporations to buy up agricultural land.

Another hitch is the acute shortage of refrigerated storage space. The grape industry in Maharashtra has done a lot in this area. While companies like ITC, Pepsi and Hindustan Levers have created some storage capacities, what is called for really is an extensive network of cold-storage depots. Here, the government has a critical role to play. It will either have to invest heavily to erect the infrastructure or else offer big tax incentives on capital goods to make it commercially viable for the private sector to set up such facilities. "Currently it is simply not feasible for companies to create large storage facilities," says Pant.

Such handicaps have deterred the corporates from moving into this industry in a big way. As a result the country processes under one per cent of all its food output. In contrast, countries with a strong corporate culture, like the US and Brazil slice, squeeze, pickle and jam around 70 per cent of their food output into a litany of branded products that have become a rage in the world gourmet market. Even relative agricultural small-fries like Thailand, Malaysia and the Philippines, have made a big splash on the global processed food trade with their mouth-watering fare of jams, juices, sauces and cereals.

Not that we don't have the processing capacity. There are 4000 processing units in the country, mostly in the small-scale sector, which together can process nine lakh tonnes of fruit and vegetable. That is a full eleven per cent of the country's total output. Against that, they are currently doing just around one per

Continued on Page No. 10

Studies on Green Almond Paste - Preparation, Storage and Utilization

by

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Abstract

The green almond paste containing different proportions of sugar (50, 65, 70% W/W) with and without added sodium benzoate (600 ppm) was stored in glass jars at room temperature (30-40°C) and low temperature (+1°C) for shelf-life studies. The samples with and without sodium benzoate kept at room temperature, spoiled within 10 days, whereas those kept at low temperature remained in good condition for a period of one year. The microbiological load in these samples was within the acceptable limits. The ready-to-serve beverages (15-16° Brix) made from the cold stored pastes of all compositions was found generally acceptable to the taste panel at different storage intervals. However the RTS beverage made from the samples of paste containing 30 and 35% green almond was liked most.

Introduction

Almonds (*Prunus amygdalus*, Batsch) are extensively cultivated in USA, Spain, Italy, Iran, Morocco and Portugal. In India, almonds are mostly cultivated in Kashmir, hilly areas of Himachal Pradesh and Uttar Pradesh¹. The almond fruits grown in the lower hills of Himachal Pradesh are generally harvested before full maturity because of the onset of rains which cause dropping of the fruits and worm infestation. The almond growers in Kashmir valley and in the upper hills of Himachal Pradesh too harvest almonds at green stage probably to take advantage of the premium price that the green almonds fetch in the market during the months of May to August. The physico-chemical characteristics and storage behaviour of green almonds have been reported elsewhere²⁻⁴.

The fully mature almond kernels are considered as a high quality ingredient in the

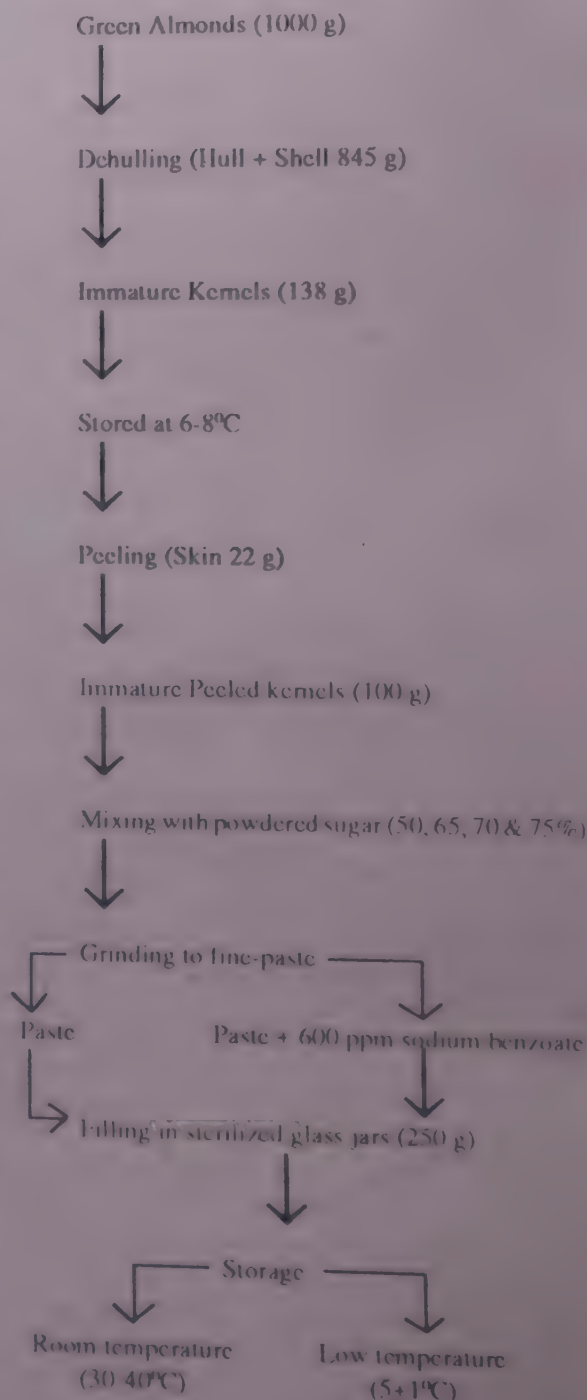
manufacture of confectionery and bakery products. The kernels may be processed as raw, dry roasted or roasted in oil or converted into powder, almond butter, almond oil and almond paste⁵. The almond paste is generally prepared by grinding the blanched, peeled kernels with requisite quantity of water and sugar⁶. The paste finds numerous applications in bakery products, confectionery and in the preparation of refreshing beverages. The immature kernels from green almonds are, however, relished as dessert only or may be processed as preserve, candy and pickle¹. The present study reports the conversion of immature kernels into paste for further use in the preparation of ready-to-serve beverages. The desired sensory attributes of almond beverage are: milky appearance, mild almond taste and flavour, homogenous optimum mouthfeel (consistency), and free from grittiness.

Materials and Methods

The green almond fruits were procured from the local market. Hulling and shelling to recover the immature kernels, were accomplished manually. The kernels were stored at 6-8°C prior to use.

Preparation of Almond Paste: The immature kernels were peeled, mixed with requisite proportion of powdered sugar (50:50, 35:65, 30:70 and 25:75 W/W kernels : sugar) and ground to a fine paste in a motorized wet grinder. Half portion of the fine paste of each blend was treated with 600 ppm sodium benzoate. The samples of paste with and without sodium benzoate were separately packed in presterilized glass jars (250 g). A total of 32 jars were filled comprising 8 jars (4 jars with benzoate and 2 without) from each blend. Four jars (2 with benzoate and 2 without) of each blend were stored at room

temperature (30-40°C) and four jars (2 with benzoate and 2 without) at low temperature (5±1°C) for shelf-life studies. The steps in the preparation of almond paste along with materials balance data are shown in the Flowsheet Diagram (Figure 1).



Flow sheet diagram for preparation of Almond Paste and Material Balance Data (Figure 1)

Analysis: The chemical analysis of the immature almond kernels and that of the

Table 1: Composition of different samples of green almond paste and dilution factors for preparation of R. T. S. beverage

Sample	Almond Kernel Sugar Ratio	°Brix	Dilution Factor	°Brix of R. T. S. Beverage
A	50:50	15.16	1 to 4.0	15.16
B	35:65	15.16	1 to 5.0	15.16
C	30:70	15.16	1 to 5.3	15.16
D	25:75	15.16	1 to 5.5	15.16

Table 2 : Chemical Characteristics of fresh and stored green almond paste at the end of 52 weeks storage at $5 \pm 1^\circ\text{C}$

Sl. No.	Characteristics	Sample Code							
		A		B		C		D	
		Fresh	Stored	Fresh	Stored	Fresh	Stored	Fresh	Stored
1.	pH	5.76	5.45	5.73	5.56	5.72	5.35	5.79	5.49
2.	Moisture %	32.18	31.50	21.43	21.61	18.75	18.81	15.15	13.89
3.	Crude fat %	N. D.	0.50	0.46	0.34	0.39	0.29	0.22	0.29
4.	Protein (Nx6.25) %	5.41	5.39	4.21	4.11	3.28	3.55	2.89	2.82
5.	Total Ash %	0.86	0.92	0.59	0.71	0.52	0.58	0.41	0.47
6.	Reducing Sugar %	Traces	15.00	Traces	9.05	Traces	6.36	Traces	5.95
7.	Total Sugar %	52.06	50.81	66.44	63.96	71.21	68.42	76.03	74.76
8.	Non reducing sugars %	52.06	34.02	66.44	52.16	71.21	58.96	76.03	65.37

paste samples was done using the standard AOAC methods⁷. the microbiological analysis for total plate count (colony forming units), coliform count, yeasts and moulds, spore formers, psychrophiles, salmonella, and *S. aureus* of both the treated and untreated samples of the paste (with and without sodium benzoate) was done at the end of 52 weeks of storage at $5 \pm 1^\circ\text{C}$.

Sensory Quality Evaluation : The samples of almond paste stored at low temperature were periodically evaluated after conversion into a ready-to-serve beverage (15-16° Brix), for colour, flavour, taste, mouthfeel (consistency and texture) and overall acceptability by a panel of seven judges who were familiar with the product. The scoring for different quality attributes was done on 10 point hedonic scale⁸, higher the score better the quality.

Results and Discussion

The fruits yielded on an average 13.8% immature kernels which contained about 68% moisture. The kernels contained 11.75 crude fat, 4.79 protein, 4.13% total sugars and 1.48% total ash.

Almond Paste : The composition and the chemical characteristics of four different blends of the almond paste are given in Tables 1 and 2 respectively. The samples A to D contained an increasing proportion of soluble solids largely contributed by the added sugar. There was a corresponding decline in protein, crude fat and total ash content in samples A to D owing to increased proportion of added sugar. The samples of paste, both with and without added sodium benzoate stored under ambient conditions, developed mould on the surface and moldy odour with 10 days of storage because of prevailing high temperature and humidity during the month of July. The samples kept at low temperature ($5 \pm 1^\circ\text{C}$), however, stored in sound condition except for a slight change in pH, colour and flavour and development of reducing sugars at the end of storage period of 52 weeks (Table 2). Addition of sodium benzoate as preservative in the paste did not show any advantage during storage.

The microbiological analysis of the almond paste (with and without added sodium benzoate) stored at low temperature for 52 weeks showed absence of coliform, salmonella, and *S. aureus*. The total colony forming units, yeasts and mould, spore formers and psychrophiles counts in the paste were within acceptable limits (Table 4).

Ready-to-serve (RTS) Beverage : The samples of almond paste at different storage intervals, were made into RTS beverages by diluting with chilled water to 15-16° Brix. The beverages were evaluated for sensory

quality attributes of colour, flavour, taste, and mouthfeel (consistency and texture) and overall acceptability. The average values of the scores awarded by the seven panelists are given in Table 3. The scoring pattern for the sensory attributes of the RTS beverage made from pastes stored for different periods, indicates only a very slight change in the sensory quality of the beverage owing to storage effect. The beverage was, however, found to be relished well by the panelists throughout the storage period.

The milky appearance and mild almond flavour and taste of the beverage was imparted by the immature almond kernels component of the paste. The paste samples containing increased proportion of the kernel therefore found to receive higher score in respect of colour and flavour. These paste samples containing 30 and 35% almond component were, however, generally liked most as evident from the taste and overall acceptability score (Table 3).

The green almonds may thus be advantageously preserved and stored as kernel paste for future use in the event of early harvest for climatic economic reasons.

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Table 3 : Sensory Quality evaluation data on R. T. S. beverage prepared from green almond paste stored at $5 \pm 1^\circ\text{C}$.

Sample Code	Storage period (weeks)	Sensory Characteristics score			
		Colour	Flavour	Taste	Mouthfeel & Overall acceptability
		(10)	(10)	(10)	(10)
A	0	8.6	8.0	7.2	7.1
	3	7.9	7.5	7.1	7.4
	5	7.9	7.4	7.4	7.5
	8	8.1	7.4	7.0	7.4
	14	8.3	7.6	7.2	7.3
	52	6.6	5.3	6.8	7.3
B	0	8.4	7.4	7.6	7.6
	3	7.5	6.3	7.2	6.8
	5	7.6	6.6	7.3	7.5
	8	8.2	6.8	7.3	7.5
	14	7.9	7.1	7.7	7.7
	52	7.1	5.8	6.8	7.8
C	0	8.4	7.0	7.4	7.8
	3	7.1	6.1	6.7	6.5
	5	7.5	6.4	6.6	6.8
	8	7.6	6.5	6.8	7.2
	14	7.8	6.6	7.1	7.5
	52	6.5	5.1	6.5	7.2
D	0	8.4	6.8	7.0	7.2
	3	6.8	5.6	6.5	6.8
	5	7.4	6.2	6.5	7.2
	8	7.5	5.8	6.5	6.9
	14	7.5	6.7	6.7	6.8
	52	6.3	4.9	6.5	6.7

Table 4 : Microbiological analysis of green almond paste (per gram) at the end of 52 weeks storage at $5 \pm 1^\circ\text{C}$.

Sample Code No.	Total Count*	Coliform		Yeasts & Molds	Spore formers	Psychrophiles	Salmonella	S. aureus
		MPN	Count					
A	ND	ND	ND	ND	ND	ND	ND	ND
B (with benzoate)	155 x 10 ⁴	Nil	Nil	1 x 10 ¹	10 x 10 ²	4 x 10 ¹	Nil	Nil
35:65								
C (with benzoate)	120 x 10 ⁴	Nil	Nil	9 x 10 ¹	9 x 10 ²	15 x 10 ¹	Nil	Nil
30:70								
C (without benzoate)	205 x 10 ⁴	Nil	Nil	2 x 10 ¹	11 x 10 ²	1 x 10 ¹	Nil	Nil
30:70								
D (with benzoate)	90 x 10 ⁴	Nil	Nil	9 x 10 ¹	5 x 10 ²	7 x 10 ¹	Nil	Nil
25:75								

* Colony forming unit. ND = Not determined

Contd. from Page No. 7

Possibility & Prospects.....

cent. The reason: a majority of them are operating at less than 40 per cent of their installed capacity and many are teetering on the brink of collapse. The entry of big-business can bring to these units what they so desperately need: Modern technology and marketing savvy.

Admittedly, the demand in India for raw food - particularly cereals - is vastly greater than in countries like the US. Even so, there is undoubtedly a huge potential for growth here that if realised could propel the country to a dominant position in the supermarkets of the world.

Global Marketing

The one factor that finally makes or breaks a brand in the cauldron of global competition is marketing. And it is an area that simply cannot do without the selling savvy and spending power of big business. Establishing a brand in markets dominated by labels with a huge reputation, constructed over several decades of careful image-building, is a very expensive enterprise. It takes marketing muscle, global presence and an almost limitless spending capacity to get anywhere. Says Pant: "The cost of launching a national brand in the US is about \$ 50 million over three years." Pepsi Foods, which launched its Season Harvest range of packaged cereals early this year in the US, has spent \$ 1.2 million in just one year of advertising.

What makes it all worth the expense is the kind of premiums branded products command once they have gained acceptance. Says Pant, quoting the example established by market-leader companies: "I can't think of one brand in the world that has been established by a government."

For that, to help India realise its untapped potential, the government must provide proactive backroom support. That alone will help the country turn agriculture into the backbone of its economy, and the spearhead of its export drive.

Acknowledgement

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Thermal Expansion Of Whole Milk, Mosami Juice and Pineapple Juice

by

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Abstract

The thermal expansion of three liquid foods, namely whole milk, mosami juice and pineapple juice were determined by standard dilatometer method at various concentrations. The initial solid content of whole milk, mosami and pineapple juice were 13.00, 5.56 and 9.80 percent respectively. The thermal expansion of whole milk was decreased from $4.13 \times 10^{-4} / ^\circ\text{C}$ to $2.84 \times 10^{-4} / ^\circ\text{C}$ as the total solid content increased from 10 to 30 percent. In mosami juice, the coefficient of thermal expansion decreased from $3.71 \times 10^{-4} / ^\circ\text{C}$ to $2.57 \times 10^{-4} / ^\circ\text{C}$ upto 12 percent moisture content. Thereafter it increased to $3.5 \times 10^{-4} / ^\circ\text{C}$ upto 24 percent of total solid concentration.

Introduction

The dairy and fruit processing plant process large amount of milk and fruit juices. The knowledge of major thermal properties, such as specific heat, thermal expansion, thermal conductivity and diffusivity of liquid food is essential to researchers and designers in the field of food engineering to increase the efficiency of plant and processing industries. The importance of such fundamental data on thermal properties and characteristics also increases. The thermal expansion of liquid foods have its prime importance in packaging, design of storage vessels and other heat exchange equipment. The thermal properties of liquid food are heavily dependent on total solid content. However, very few reports are available on effect of concentration of food products on thermal expansion and other properties. Therefore, this study was undertaken to determine the thermal expansion for whole milk, mosami and pineapple juice at various concentrations.

Materials and method

Whole milk was obtained from the distributing centre of Rajasthan Co-operative Dairy Federation (RCDF). The mosami and pineapples were procured from local market. Juice was extracted with a hand operated juicer.

The fat content of whole milk was obtained by standard Gerber method. The air entrapped in milk, when brought under the

actual reading was released by heating the milk to about 90°C and then cooling it down to $20-22^\circ\text{C}$. Lactometer reading (LR) of milk taken was corrected by standard formula given below:

$$\text{C. L. R.} = \text{LR} + (\text{T} - 60^\circ) \times 0.1$$

Where T and 60° are temperatures in $^\circ\text{F}$ at which lactometer reading is being taken.

The total solid content of whole milk was determined by adding solid not fat and fat in percent. The value of solid not fat (SNF) is given by

$$\text{SNF} = \frac{\text{CLR}}{4} + 0.21 \text{ F} + 0.4$$

Where SNF = solid not fat

CLR = corrected lactometer reading

and F = Fat in percentage

The total solid content of mosami and pineapple juice were determined by standard oven dry method. When a vessel containing liquid is heated, both vessel and liquid expand. Therefore two kinds of expansion are observed namely apparent and real.

Table 1. Variation of Final Average Coefficient of Thermal Expansion with total Solid of Whole Milk

Total Solid (%)	Average coefficient of thermal expansion of sample - A $\times 10^{-4} / ^\circ\text{C}$	Average coefficient of thermal expansion of sample - B $\times 10^{-4} / ^\circ\text{C}$	Average coefficient of thermal expansion of sample - C $\times 10^{-4} / ^\circ\text{C}$	Average in $^\circ\text{C}$ of sample A, B, & C $\times 10^{-4} / ^\circ\text{C}$
13	4.390	4.103	3.891	4.127
14	3.912	3.891	3.693	3.831
15	3.621	3.752	3.650	3.674
16	3.451	3.587	3.591	3.543
17	3.313	3.412	3.492	3.405
18	3.152	3.301	3.413	3.288
19	2.951	3.123	3.399	3.157
20	2.893	3.010	3.261	3.054
21	2.815	2.912	3.197	2.974
22	2.762	2.873	3.141	2.925
23	2.702	2.712	3.098	2.837

Table 2. Variation of Final Average coefficient of Thermal Expansion with total solid of mosami juice

Total Solid (%)	Average coefficient of thermal expansion of sample - A $\times 10^{-4} / ^\circ\text{C}$	Average coefficient of thermal expansion of sample - B $\times 10^{-4} / ^\circ\text{C}$	Average coefficient of thermal expansion of sample - C $\times 10^{-4} / ^\circ\text{C}$	Average in $^\circ\text{C}$ of sample A, B, & C $\times 10^{-4} / ^\circ\text{C}$
6	3.559	3.393	4.195	3.715
8	2.710	2.921	3.892	3.174
10	2.105	2.851	3.652	2.769
12	2.059	2.295	3.351	2.568
14	2.254	2.310	3.153	2.572
16	2.493	2.421	2.895	2.603
18	2.712	2.613	2.705	2.676
20	2.952	2.820	2.652	2.808
22	3.225	3.253	2.815	3.097
24	3.629	3.695	3.203	3.509

Table 1: Variation of final average coefficient of thermal expansion with total solid of pineapple juice

Total Solid (%)	Average coefficient of thermal expansion of sample - A $\times 10^{-4}/^{\circ}\text{C}$	Average coefficient of thermal expansion of sample - B $\times 10^{-4}/^{\circ}\text{C}$	Average coefficient of thermal expansion of sample - C $\times 10^{-4}/^{\circ}\text{C}$	Average in $^{\circ}\text{C}$ of sample A, B, & C $\times 10^{-4}/^{\circ}\text{C}$
10	2.923	2.901	3.150	2.991
12.5	3.412	3.225	3.413	3.350
15	3.925	3.513	3.705	3.714
17.5	4.595	3.892	4.015	4.167
20	5.237	4.310	4.319	4.645
22.5	6.000	4.798	4.621	5.139
25	6.583	5.487	5.002	5.690
27.5	7.290	6.395	5.315	6.333
30	7.952	7.230	5.715	6.965

apparent expansion is expansion of liquid relative to vessel, while the read expansion is equal to the sum of apparent expansion and expansion of vessel. The thermal expansion of all three liquid foods were determined by Dilato meter. In this method, a test tube was filled with the liquid food of known volume. A rubber cork through which the graduated glass tube was introduced, was then put into the test tube and pressed till certain amount of liquid was raised in the glass tube column. The volume of the liquid which split during this process was also recorded and subtracted from the total volume of liquid in the test tube. This volume was termed as initial volume (V_1).

The test tube was then placed in the stand inside a rectangular container filled with water upto the neck so that proper heat transfer to the liquid could take place. The temperature of water was then increased from T_1 to T_2 which resulted in the rise in liquid level in the graduated glass tube. The new level of liquid food was then recorded and termed as V_2 . The process was repeated till the water temperature attained 60-65°C. The apparent coefficient of cubical expansion is then calculated by following formula:

$$Ca = \frac{V_2 - V_1}{V_1(T_2 - T_1)}$$

The coefficient of cubical expansion of glass test tube was then added to apparent coefficient of cubical expansion of liquid food to find the real coefficient of cubical expansion.

Results and Discussion

The average initial total solid content of whole milk was 13.00 percent. The average value of coefficient of thermal expansion with variation in total solid content in whole milk was given in Table 1. The variation in thermal expansion coefficient was observed for 13 to 23 percent of total solid content in whole milk and found that it decreased to $2.84 \times 10^{-4}/^{\circ}\text{C}$ from $4.13 \times 10^{-4}/^{\circ}\text{C}$. These data were analysed and straight line equation

with coefficient of correlation $r = -0.9816$ was obtained. The coefficients of equation and r value are also shown in Fig.1

The variations of coefficient of thermal expansion for mosami juice were observed for 6 percent to 24 percent of total solid content, as shown in Table 2. The average initial total solid content in mosami juice was 5.56%. The thermal expansion at 6% solid content was observed to be $3.71 \times 10^{-4}/^{\circ}\text{C}$. It was found that the values of coefficient of thermal expansion decreases when total solid content of mosami juice increases upto a certain value. At 12% solid content, the minimum value of coefficient of thermal expansion was observed and that was $2.57 \times 10^{-4}/^{\circ}\text{C}$

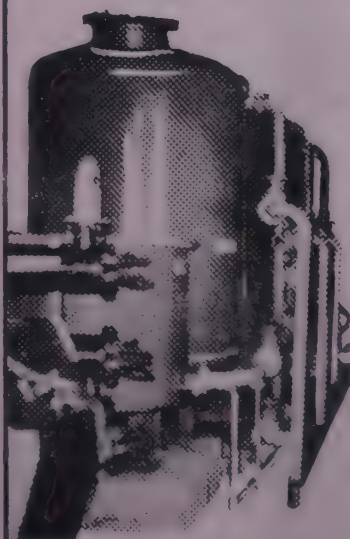
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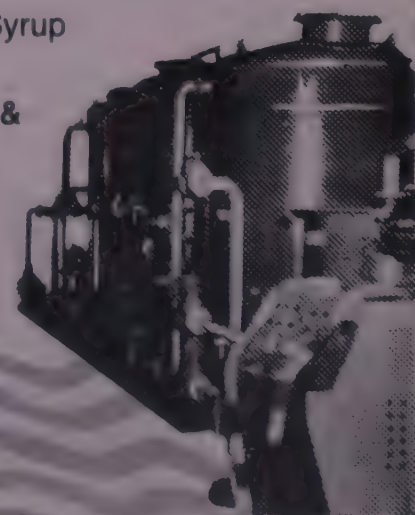
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Food Extrusion

by

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The food industry today has at its disposal, a unique multipurpose piece of equipment - the Cooker/Extruder, probably the single most versatile processing tool available. The Cooker/Extruder is a continuous conveyor reactor which, at the same time is a mixer, heat exchanger, pressure vessel, reactor, shearing device and expander which sequence of operations except for the last may be applied in any order and to differing degrees either singly or together. This unique processing tool has found wide and increasing applications in many product areas as listed in Table 1.

Extruders can be found in a variety of sizes and types but in general they consist of a fixed metal barrel through which the material is transported. An extruder is composed of five principal components namely a feeding mechanism, a screw and its driving mechanism, a screw sleeve or barrel, a flow restrictor or die, and cutting mechanism.

The actual equipment falls into three primary categories, namely single or twin screw extruder with the single screw extruder subdivided into low and high pressure extruders.

Five types of single-screw extruders commonly used in the food industry are as shown in Table-2.

The Schematic diagram of single screw extruder is shown in Fig 1. Various screw configurations for single screw extruder are shown in Fig 2.

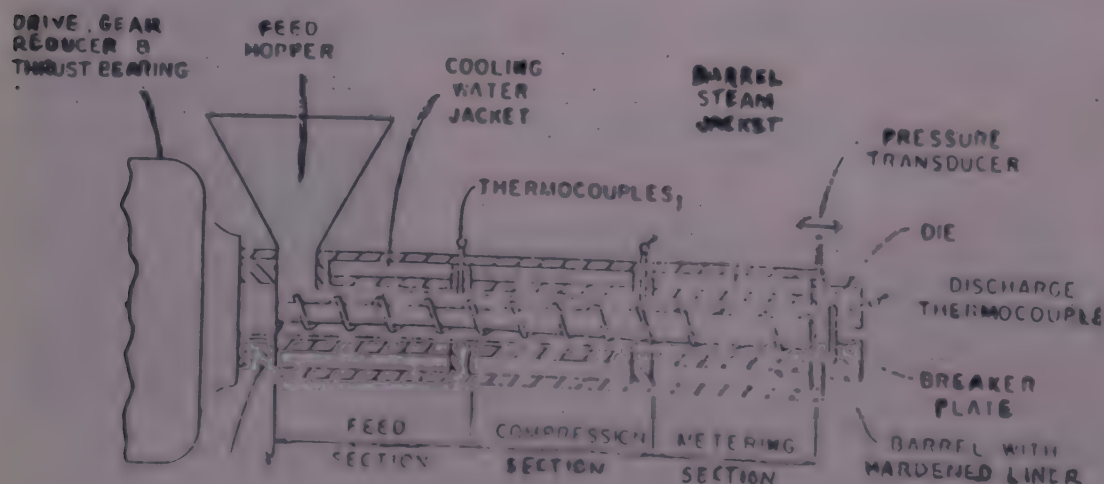


Figure 1: Component parts of a high shear cooking extruder
Source: Harper, J. M., 1979

Table 1 : Applications for Food Extruders

Extrusion / Cooking (High Pressure)	Extrusion (Low Pressure)
1. Infant Foods	1. Pasta
2. Instant Beverages and Soups.	2. Half or third generation snack foods
3. Cooked whole grains	3. Biscuits
4. Quick cooking vegetables	4. Crackers
5. Breakfast cereals	5. Bread
6. Precooked flour and grits	6. Tortillas
7. Crispbreads	7. Food bars
8. Bread sticks	8. Structured Proteins
9. Croutons	9. Confectionery items mainly sugar
10. Instant noodles	10. Frozen products
11. Dumplings	11. Meat products
12. Pregelatinised starch	12. Butter / Margarine
13. Snack foods	
14. Textured vegetable proteins	
15. Meat analogues	
16. Pet foods - dry and semimoist	
17. Vegetable protein treatment	
18. Animal feed	
19. By-product treatment	
20. Reactions-hydrolysis, chemical modification etc.	

Source : D. E. Blenford, 1983.

For simple straightforward, low-rate extrusion operations, single screw extruders are quite adequate. For more demanding processing requirements twin screw extrusion technology must be used.

Twin screw extruders are generally categorised according to the direction of screw rotation and to the degree to which the screws intermesh. As shown in Fig 3, the screws either rotate in opposing directions (counter-

rotating) or in same direction (co-rotating).

Intermeshing counter-rotating and co-rotating screws differ in their working. In counter-rotating systems, the screws roll off one another in the wedge area (intermeshing zone) with locally different relative gliding velocities. Co-rotating screws do not roll off one another at any point. In contrast to the rolling motion, movement is translational where one crest edge wipes a screw flank

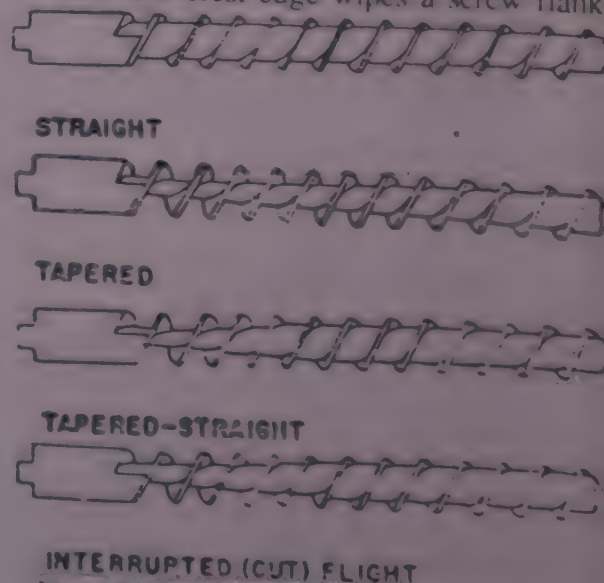


Figure 2: Various types of mono-piece screws
Source: Ahmed A. El-Dash, 1981

Table 2 : Types and applications of single screw extruders used in the food industry Single screw Extruders.

1	2	3	4	5
Pasta Extruder	High pressure forming Extruder	Low shear Continuous cooker	Collet Extruder	High Shear Cooking Extruder
-forming Macaroni and similar products from a dough	-compressing and shaping pregelatinised dough to products requiring further processing such as deep fat frying (Snacks) and gun puffing (Cereals)	-has wide variety of applications. Continuous cooker for high moisture dough / feeds. - product to be further processed by forming, drying etc.	-cools, puffs, forms dry granular feeds to puffed snack products. - High Shear Short residence time extruder. - Relatively inflexible, produces a narrow range of products from a narrow range of ingredients	-more flexible than 4. -produces may products such as puffed cereals, snacks and dry pet foods from a wide range of dry ingredients and mixes-similar to 4 with longer residence time.

tangentially with constant relative velocity.

There are three different basic screw types associated with twin screw extruders (Fig 4). Three-lobe systems have low volumetric capacities and are used primarily where high-energy input and high average shear rates are required. This system is seldom used in food industry. The two-lobe system is the standard design for the twin screws in the food industry. It has good feed intake characteristics with low bulk density materials, high conveying rates, and relatively low average shear rates, which result in a gentler treatment of the product. Single-lobe screws may be used with either system when increased conveying capacity or pumping ability is needed. Average shear rate is very low and these screws can build pressure in a short length and may be used in the feed zone to enhance feeding of non free-flowing materials.

Twin screw extruders offer several advantages over single-screw extruders, which could make the use of twin-screw machines more economical on a long-term basis despite higher initial costs.

In operation two advantages are process

control and continuity of operation. Extrusion speed and temperature may be adjusted to obtain desired texture and density over a range of outputs. Better control can result in less waste.

Ingredient feed interruption or inadvertent changes in conditions, have little effect on twin screw machines. These extruders continue to run during stoppages in ingredient flow chiefly because the screws are self cleaning. However single-screw extruders depend on a continuous flow of material to maintain extrusion, and short feed interruptions can cause complete shutdowns that require machine disassembly. Twin screw machines will purge themselves quickly and material extruded after problems are corrected will usually be normal. But this is not the case with single screw extruders which depend on a continuous flow of material to maintain extrusion. Short feed interruptions can cause complete shutdowns that require machine disassembly and thus lengthen the time needed to resume normal extrusion.

The residence time 'tail' is inherent in single-screw machines. This tail is due to the poor conveying characteristics compared to

co-rotating twin-screw machines and to build-ups which can form on screw flanks. These build-ups contribute adversely to the residence time tail and in some cases can break loose and cause die plug-ups or product degradation. The self wiping characteristics of co-rotating twin-screw extruders prevents these build-ups.

Since twin screw extruders are self cleaning, quick and efficient product changeovers and replacing dies is possible without disassembling the machine. Twin-screw extruders will process some formulations that are difficult for single screw machines, which include light density powders that have low purging ability and materials that are sticky or gummy. Other advantages claimed for twin-screw machines are the ability to process formulations with higher fat or sugar contents and lower energy costs resulting from their ability to process formulation at a lower moisture content.

The raw materials that may be utilised for extrusion are wide ranging, some of them are shown in Table 3.

Table 3 : Raw materials used in extrusion of foods.

- Starches
- Starches containing materials
- Cereals flours - Wheat, maize, rye, rice, buckwheat, oat, etc.
- Tuber flours such as potato, cassava
- Vegetable Proteins - Soyabean flours
- Rusks and other baked farinaceous materials
- Meat / Fish Products.

The number of process applications for extrusion are increasing steadily. Basically they fall into three categories.

1. Cold formed products such as noodles, macaroni, spaghetti etc.

2. Gelatinised products : Gelatinisation means production of pellets for snack foods of the third generation. These can be later expanded in boiling oil. Gelatinised products can also be powdered and used in soup premixes and some beverages.

3. Expanded products : These foods are

SCREW ENGAGEMENT		SYSTEM	COUNTER ROTATING	CO-ROTATING
INTERMESHING	FULLY INTERMESHING	LENGTHWISE AND CROSSWISE CLOSED	1	2 THEORETICALLY NOT POSSIBLE
		LENGTHWISE OPEN AND CROSSWISE CLOSED	3 THEORETICALLY NOT POSSIBLE	4
		LENGTHWISE AND CROSSWISE OPEN	5 THEORETICALLY POSSIBLE BUT PRACTICALLY NOT REALIZED	6
	PARTIALLY INTERMESHING	LENGTHWISE OPEN AND CROSSWISE CLOSED	7	8 THEORETICALLY NOT POSSIBLE
		LENGTHWISE AND CROSSWISE OPEN	9A	10A
			9B	10B
NOT INTERMESHING	NOT INTERMESHING	LENGTHWISE AND CROSSWISE OPEN	11	12

Figure 3 : Types of twin-screw mechanisms

Source : C. Mercier, P. Linko, J. M. Harper, 1989

Table 4 : Extrusion cooked products replacing conventional processes.

Product group	Product Example	Conventional Process
Modified cereal flours	Baby food	Drum dryer
Animal food	Petfood	Autoclave or oven
Dairy food	Cascinate reaction	Stirred tank reactor
Flavors	Roast flavors, caramel	Roasting tank
Baked articles	Flatbread, biscuits	Baking oven
Breakfast cereals	Puffed rice, cereal flakes	Puffing gun
Farinaceous food	Glass noodles, fish noodles	Batch cooker
Sweet articles	Liquorice, fruitgums, Chocolate	Cooker and mogul conche

Source : Wiedmann, W., 1987.

primarily starchy and are ready to eat products. Breakfast cereals and snacks represent most of the foods in this category. Extruded snacks are available in a variety of shapes such as curls, tubes, rings, wheels, and rods. Ready to eat cereals have grown in popularity as breakfast items.

A special category of extruded product is the texturised vegetable protein. As the protein containing mixture is fed into the extruder it is worked upon and heated. The mixture expands causing the protein molecules to denature and form a new fibrous structure. The mass is then forced through a die to form expanded texturised strands of protein which may be fibrous, flaky or layered.

Many conventional processes are being replaced by extrusion processing as shown in Table 4. Newer analogs, such as crabmeat, shrimp and even dal analogs are being designed on extrusion cookers. Newer materials such as valuable by-products of seed processing residues such as sunflower, pumpkin, corn or rice germ presscake are being attempted as co-extrusion materials with cereals.

Starches undergo several significant structural changes during extrusion that include gelatinisation, melting and fragmentation, which affect their rheological properties. These have been reviewed at length by Lai and Kokini (1991).

Proteins show a very wide range of extru-

sion behaviour that is probably related to large differences in their association properties. New peptide bonds, formed by free amino and carboxylic groups of the proteins are postulated as being responsible for the crosslinking that takes place in proteins during extrusion. Extrusion can improve the digestibility of proteins, while reducing gossypol, proteinase inhibitors, allergens, aflatoxins and other undesirable compounds.

The Indian Scene

Extruded foods are neither new nor novel to India. Simple mechanical extrusion of food pastes using a piston and die has long been practiced in the home to make products like sev, chakli, murukku, string-rice and so on.

Industrially the technology made a beginning less than two decades ago and currently, the range of products made in the country include, textured soy proteins, snack foods-ready to eat and half products, breakfast cereals, weaning food, nutritional supplements for social welfare programmes etc.

Table 5 and 6 show the market shares of various extruded food manufacturing companies and zonal consumption patterns of the same.

The expanded snacks pellets i.e. ready to fry products, have shown an increase in demand during the last three years at the rate of more than 15%. The increase in demand of these items resulted from the bulk sale of the products, majority of which are wheat flour

based. Organised sectors have not been much successful because of high advertising and packaging cost of their products.

Table 5 : Market shares of various extruded food from various companies and volume of various industries in tonnes.

Company	Installed Capacity	Sale	
		1989	1990
SM Dyechem	2400	1200	1800
TTK Pharma	5000	1800	3000
Surya Agroil	2400	2160	1800
Shree Food	2400	750	1000
Reliable Food	720	250	350

Source : SBP Handbook of Export Oriented Food Processing Projects, 1993.

Table 6 : Volume of pellets in percentages-zonewise consumption

Total sale of pellets 1990 : 6950 tonnes				
Zone :-	North	East	West	South
Percentage				
Consumption :	50	10	25	15

Source : SBP Handbook of Export Oriented Food Processing Projects, 1993.

The use of extrusion cooking has many distinct advantages making it the wonderkind of modern food processing. It is claimed that 60% of the products manufactured by this process is as yet unknown today and the technology is most exciting for what it is yet to accomplish.

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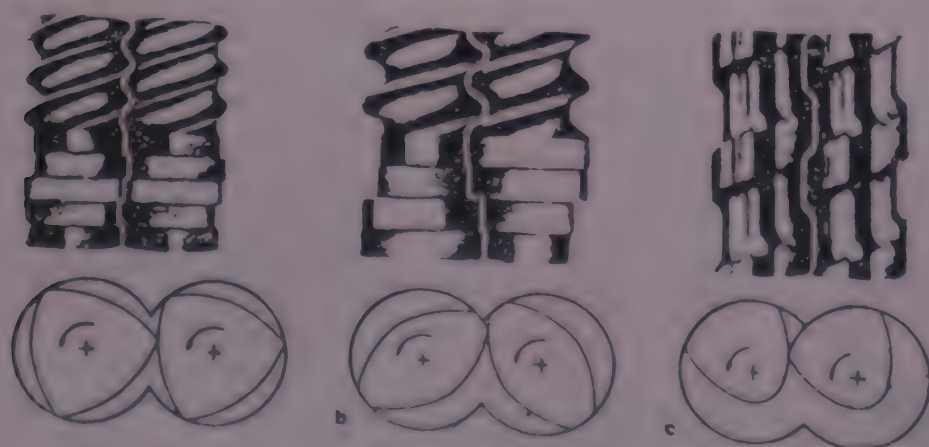


Figure 4 : Operating principles of counter-rotating systems. a. three-lobe design;

b. two-lobe design; c. single-lobe design

Source : Schuler, E. W., 1986

Energy Consumption and Conservation in Edible Oil Processing

by

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Introduction

Oil seeds constitute the second largest agricultural commodity next only to food grains. In the year 1992, India produced 20.0 million tonnes of oilseeds. Present production of edible oil in India is about 50 lakh tonnes and in the year 1989-90 about 10 lakh tonnes of oil was imported. Three production systems operate to yield vegetable oil: the ancient ghani system which produces barely 5 per cent of the total oil output. Next is the expeller from which 85 per cent of our vegetable oil is extracted and the third system, solvent extractor, yields the remaining 10 per cent oil.

Increased cost of energy and unpredictable supplies of fuel have created a new dimension in business management. The share of energy cost in the total operating cost is increasing day by day. Energy cost now features as a significant factor in economic activity, on par with factors of production such as capital and labour. The imperatives of an energy shortage situation call for energy conservation measures, which essentially means using less energy for the same activity.

Energy consumption in oil processing

Oil is extracted from oilseeds by rupturing the oil cells or by solvent percolation. In the expeller, it is the separation of liquids from solids by application of compressive forces. Expeller is a continuous device consisting of rotating worms closely fitted inside slotted cage or barrel. The rotation of the worm cause a movement of the material in forward direction, inside the barrel is pressure increases, liquid is expelled out. The expelled oil is passed through the plate filter press for the removal of suspended impurities from the oil. The thermal energy in terms of steam is used in the expeller for cooking the oil seed flakes in the kettle and the open steam is given in the expeller. This heat is utilized for raising the temperature of cake and oil. The values of electrical and thermal energy required for extraction of one tonne of oil in the expeller are 135.66 kw and 1409 MJ respectively (Table 1). The electrical energy is required in expelling section for mechanical preparation (11.2%), expeller operation (83.2%), filtration and pumping (5-6%). The

heat loss in the expelling section is 496 MJ per tonne of oil (Table 2). This is the heat carried as sensible heat by the oil and the cake.

Table 1 : Energy requirement of oil processing plant (per tonne of oil).

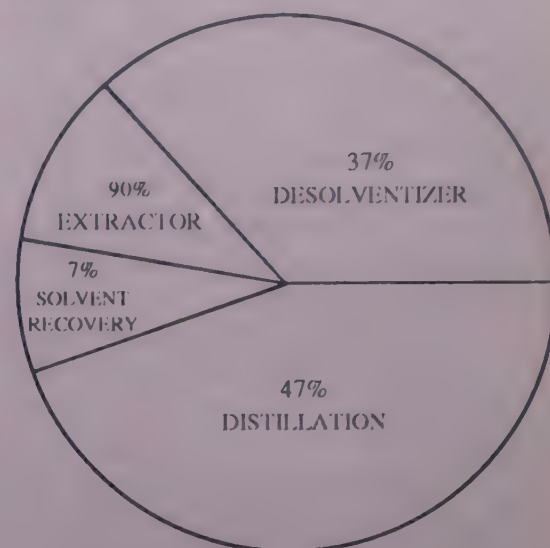
Sl. No.	Operation	Thermal MJ	Electrical kWh
1.	Mechanical expelling	1409	135.66
2.	Solvent extraction	4527	352.14
3.	Oil refining	1649	33.28

Table 2 : Thermal energy loss on oil processing (per tonne of oil)

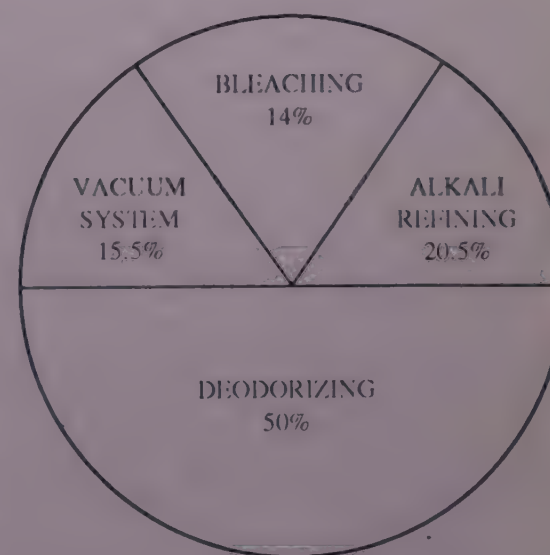
Sl. No.	Mode of energy loss	Energy loss, MJ
1.	Heat loss in expelling section	496
2.	Heat loss in solvent extraction	3234
3.	Heat loss in oil refinery	660

The solvent extraction is a commercial method used for extraction of oil from variety of oil bearing materials in general and low oil bearing materials in particular which are not easily amenable to mechanical expression. The oil is removed by diffusion of solvent and oil through the cell walls of the materials. In this method, solvent is sprayed over a moving bed of oil bearing and the oil-solvent mixture (miscella) is collected from the bottom. The oil is recovered from miscella by distillation. The electrical energy required for solvent extraction is 352.14 kWh/tonne of oil (Table 1). The electrical energy in the plant is mainly consumed by extractor (8.2%), handling of cake (43.4%), pumping of oil, solvent and water (48.4%). The thermal energy required in the solvent plant is 4527 MJ per tonne of oil and this heat energy in the form of steam as shown in the Figure-1, is utilized in extractor (9.0%), desolventizer (37%), distillation unit (47%) and solvent recovery unit (7%). The heat energy loss in the solvent plant occurs through the sensible heat carried by oil and cake and the latent heat of solvent lost in the condensor. This heat loss is about 3234 MJ per tonne of oil.

The edible oil refining is done in three stages - alkali refining, bleaching and deodorizing. The main objective of refinery is



(a) SOLVENT EXTRACTION



(b) REFINERY

FIG. 1. ENERGY CONSUMPTION PATTERN IN OIL PROCESSING

to produce an almost neutral oil by removing the impurities, colouring matter and odoriferous compounds. In the alkali refining the reagent is added in the oil and the mixture is washed with hot water and the soap is separated from the oil in a disc type centrifugal separator. For removing traces of soap particles from oil, it is sent for second stage washing and separation. The absorption affinities of certain substances is used for removal of colouring matter from the oil. The

bleaching operation is performed under vacuum in a reactor and then the charge of the bleacher is passed through the pressure leaf filters for separation of earth particles. The various odour giving compounds are removed by vaporization under high vacuum and spurge steam aid. The oil refining requires 33.28 kw of electrical energy and 1649 MJ of thermal energy for processing one tonne of oil (Table 1). The heat energy is mainly used in alkali refining, bleaching and deodorizing and about 40 per cent of total electrical energy required for refinery is consumed in vacuum system. The heat energy loss in oil refinery is 660 MJ per tonne of oil.

Energy Conservation in Oil Processing

The various methods of energy saving for oil processing developed and used by research workers or engineers are discussed under following points.

1. The combination of expanded ghani facilities backed by solvent extraction would extract all of the oil with the maximum speed (Acharya, 1979).

2. Preheating of oil seeds with hot water offers a distinct advantage over preheating with steam and result in better oil recovery in the expeller (Pathak, 1988). The heat content of the steam condensate from the expeller is 14.7 MJ per tonne of oil produced. This condensate can be used for preheating the oilseeds or can be recirculated in the boiler for steam generation. Similarly, the surface losses from condensate and steam pipes can be reduced by suitable insulation on the pipes.

3. The use of vacuum drying for drying the meal from desolventizer to desired moisture level, can save approximately 50 kg per tonne of steam (Jongeneelen, 1976).

4. In the area where energy cost are high and likely to increase faster than general price, the extraction of oil by supercritical CO₂ under high pressure can be developed into a commercial process which is yet not promoted in industry (Juristowszky 1983).

5. The use of modern equipment for desolventization, a rising film evaporation which can use steam condensate from the

plant and concentrating the miscella from 45 to 47 per cent, about 50 kg of steam can be saved. Also, by operating the extractor section under pressure of approximately 1.5-2.5 bar over pressure and at temperature around 95-115°C, the heat of the solids plus hexane contained at 115°C to be flash-cooled to approximately 70°C can reduce 100 to 110 kg of steam (Schumacher, 1983).

6. The recirculation of 50kg per cent exhaust air in the meal drying can result about 40 per cent saving of heat energy compared to without recirculation. The use of plate-type miscella preheater that uses the heat from the hot crude oil from the stripper and imparts it to the cold miscella, steam saving of approximately 260 kg/h are realised for a 1000 tonne per day plant. The use of heat exchanger in recovery section, which is already in practice, could save steam of approximately 181.8 kg/h for a 20000 lit/min mineral oil system (Dada, 1983).

7. In the oil refinery, by simplifying the different circuits for products and auxiliary fluids, recovering heat used in processing and increasing efficiency of live steam injected during deodorization, it is possible to reduce the steam consumption in neutralization, bleaching line (from 183 to 106 kg/tonne oil) and in steam, water and heating energy consumption in the semicontinuous deodorizing plant (live steam by 17kg, heating energy from 500 to 150 MJ, water for oil cooling from 25 to 2.75 m³/tonne of processed oil).

8. A 325 MT bleaching system with heat recovery can conserve 16 tonne of steam and the deodorizing unit with effective regeneration can save 32.7 tonnes of steam. The feedstock and make-up water preheating recovers approximately 65 per cent of heat contained in hot deodorized oil. In vacuum system, by drop in water temperature to 26.7°C reduces the steam required by 33 per cent (Gavin, 1983).

9. By preheating incoming crude oil by dequimmed oil and then by using bleaching oil to heat the oil before separation in the primary centrifuge, steam uses can be re-

duced by 75 per cent (Latondress, 1984).

10. The solvent extraction plant and oil refining unit should be designed to incorporate co-generation so that a part of the mechanical power requirement of these plants may be met internally (Pathak, 1988).

11. The membrane processing has potential for saving both capital cost and energy. By using it, the installation costs were 22 per cent lower, cooling water was 7 per cent lower, electrical power consumption was 62 per cent lower and refining losses were 60 per cent lower than caustic refining. By using membrane technology and physical refining at least 21 per cent thermal energy could be saved. By using membrane technology, the thermal energy saving in storage was 224 kcal and in refining and bleaching was 122.3 kcal. Moreover, it will reduce bleaching time and the amount of clay use by half and there is no need of soapstock acidulation (Koseoglu, 1990).

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Thermal Expansion Of Whole Milk....

°C. Thereafter the coefficient of thermal expansion starts increasing upto 24% of total solid. These data were analysed and second order equation was obtained. The value of constants of equation and coefficient of correlation are given in Fig. 2.

relation are given in Fig. 2.

The average initial solid content of pineapple juice was 9.80 percent. The coefficient of thermal expansion for pineapple juice was determined at different solid concentrations varying from 10 to 30 percent. These values are given in Table 3 and presented in Fig. 3. In general, it was found that coefficient of

thermal expansion increases with increase in total solid content. This variation was from $2.99 \times 10^{-4} / ^\circ\text{C}$ to $6.96 \times 10^{-4} / ^\circ\text{C}$ for the experimental range of solid concentration. The data were analysed and straight line regression equation were developed. The constant of equations and coefficient of correlation are also given in Fig. 3.

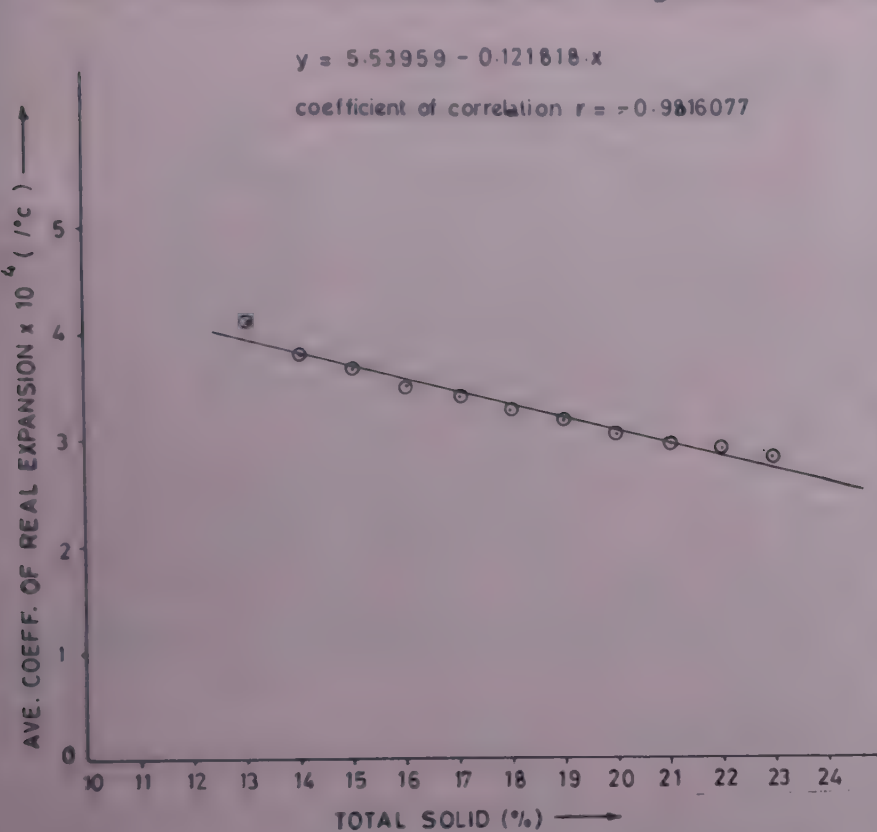


FIG. 1: VARIATION OF AVERAGE COEFFICIENT OF THERMAL EXPANSION WITH TOTAL SOLID OF WHOLE MILK

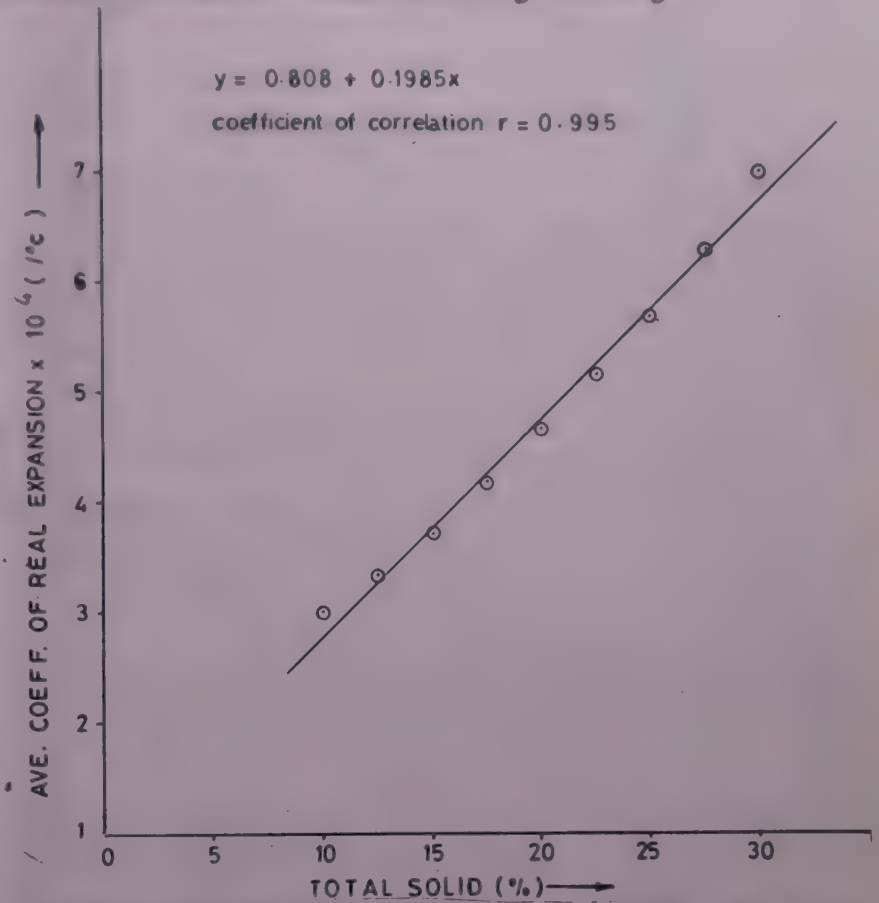


FIG. 3: VARIATION OF AVERAGE COEFFICIENT OF THERMAL EXPANSION WITH TOTAL SOLID OF PINE-APPLE JUICE

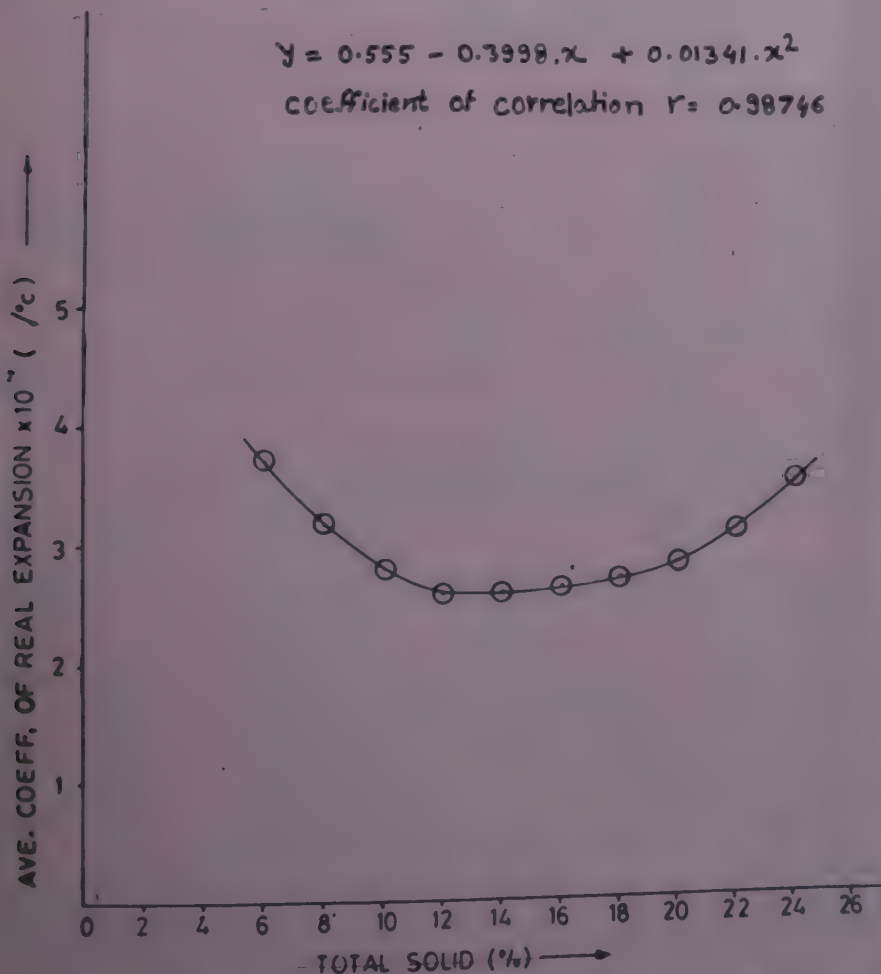


FIG. 2: VARIATION OF AVERAGE COEFFICIENT OF THERMAL EXPANSION WITH TOTAL SOLID OF MOSAMI JUICE

Conclusions :

The variation of average coefficient of thermal expansion with change in total solid content for whole milk, mosami and pineapple juice are given in Fig. 1 to 3. It can be seen from these curves that trends were linear for whole milk and pineapple juice and curvilinear for mosami juice. Further, for whole milk and pineapple juice, the slope of lines is opposite. Therefore, it can be concluded that the coefficient of thermal expansion of the liquid food is more dependent on the inherent properties of the total solids instead of the total solid concentration.

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Sensory Characteristics and Nutrient Composition of Button (*Agaricus bisporus*) Mushroom Products

by

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Abstract

The study was undertaken with the objective of developing ready-to-eat mushroom products and determine their organoleptic characteristics, overall acceptability and proximate nutrient composition which ultimately help in popularizing mushroom and improve the post-harvest utilization. Sensory evaluation showed that all the tested products were acceptable but Mushroom Munchoori, Swiss Roll, Choux Pastry and Pudding were scored to be superior among them. And the nutritive value range was Protein 1 to 8 g; Fat 3 to 24 g; Energy 25 to 320 K.Cal; Ash 0.5 to 0.9 g; Crude fibre 0.1 to 0.9 g; Carbohydrate 0.1 to 41.9 g; per 100 g. of product on raw weight basis.

Introduction

Mushrooms are the fruiting bodies of higher fleshy fungi which grows on the decomposed organic matter and produces nutritionally acceptable food. It is generally an umbrella like structure made of edible part a cap (pileus) and a stalk (stipe), Mushrooms have been considered universally as food crop and are cultivated on commercial scale in many parts of the world for their delicacy and dietary value. Mushroom are described as "The precious pearls of cookery" which is useful part of the vegetable kingdom. At various times and places mushrooms are known as "Poor Man's Meat". It contains very little carbohydrate and fat but is high in protein. Mushrooms offer variety in vegetarian diet, with their characteristic texture and pleasant flavour. The popular commercially cultivated mushrooms are Button Mushroom (*Agaricus bisporus*), Paddy straw mushroom (*Volvariella* species) Oyster mushroom (*Pleurotus* species) and Shitake of Japan (*Lentius edodes*). The world production of mushroom was reported to be 37,63,000 tonnes during 1989-90 (Flegg, 1922) where as India contributes 7,000 tonnes (Chadha, 1992). Mushrooms are becoming popular in India day by day due to favourable ecological factors and plenty of available agricultural and farm waste materials. At present in published literature most of the mushroom recipes are from outside India rather than indigenous one. There is a need for creating awareness regarding selection of mushrooms,

mushroom cooking with newly developed mushroom recipes. Studies on acceptability of mushroom product is necessary by developing consumer acceptable recipes. Therefore, the present study was undertaken with the objective to develop ready-to-eat button mushroom (*Agaricus bisporus*) products and evaluate their sensory characteristics, overall acceptability and nutritive value.

Materials and Methods

Button mushrooms were obtained from Indian Institute of Horticultural Research, Hessarghatta, Bangalore and Maharaja Cold Storage, Jayanagar, Bangalore.

Ten products were prepared using each of the popular five methods of cooking, namely boiling, steaming, sauteeing, frying and baking (Table-1.) The standard recipes followed are present in many books which have the method of preparation for these products. But each of these recipes are modified slightly and mushroom are included upto 50% of the total ingredients (Sandhya, 1993). To cut short the length of the article the recipes are not furnished here. The products were evaluated for sensory characteristics and overall acceptability on five point scale from 1. Very Poor; 2. Poor; 3. Fair; 4. Good; and 5. Very Good by an experienced panel of ten members from Department of Rural Home Science, University of Agricultural Sciences, Hebbal, Bangalore. Evaluation was on repli-

cate samples in two separate sessions at 10 am to 12 noon each day. In each session, 4 products were served to the panel members. Only for the best accepted products actual laboratory analyses for proximate nutritive values were computed taking into consideration the major ingredients' individual nutrient content (Gopalan et al. 1997).

Mean scores for the acceptability of each product and overall mean for each test product were computed. Completely randomised design was applied for the sources to check if there was any significant difference between the product and to select best accepted product for nutritional analysis.

Results and Discussion

Ready-to-eat mushroom products were prepared by using fresh button mushroom (*Agaricus bisporus*) and the results were presented in Table-1 which shows the mean score for sensory characteristics of each of the products developed and presented to the panel for evaluation.

For character, appearance mean scores ranged from 3.6 (sauteed products) to 4.8 (mushroom pudding), There was no significant difference between the two mean scores of sauteed products and also between baked products like sauteed mushrooms, chops and swiss rolls, choux pastry.

For character, aroma, the mean scores ranged from 3.8 (sauteed mushroom) to 4.4

Table 1 : Mean Scores, Overall Mean and Ranks obtained for Sensory Evaluation of Ready-to-eat mushroom products

Method of cooking	Product	Appearance	Aroma quality	Texture mean	Eating	Overall	Rank
Boiling	Curry	3.7	3.9	3.8	3.9	3.83	IX
	Mushroom with Noodles	4.2	4.2	4.1	4.3	4.20	V
Steaming	Pudding	4.8	3.9	4.1	4.3	4.38	IV
	Idli	4.0	4.0	4.1	4.2	4.08	VI
Sauteeing	Sauteed Mushroom	3.6	3.8	3.7	3.7	3.70	X
	Mushroom chops	3.6	4.1	3.8	3.9	3.90	VIII
Frying	Mushroom omelette	3.8	4.0	4.9	4.1	3.98	VII
	Mushroom Munchoori	4.6	4.3	4.5	4.6	4.53	I
Baking	Swiss roll	3.5	4.3	4.3	4.5	4.45	III
	Choux Pastry	4.7	4.3	4.4	4.6	4.50	II

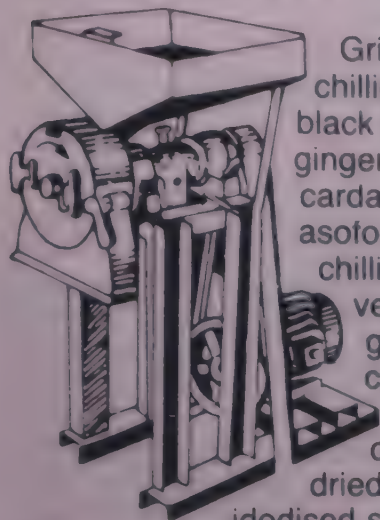
"F" Cal = 11.33 * F tab = 2.25
SE = 0.10 CD = 0.20

* F Cal is significant at 5% level

Score Index : 1-V Poor to 5-V. Good
Panel Judges : 10
Replications : 2

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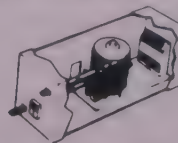
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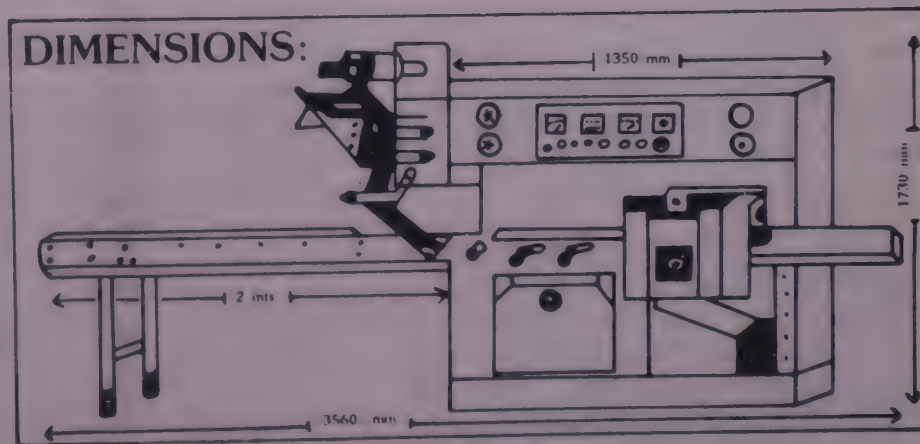
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(mushroom munchoori). There was no significant difference between steamed products viz., mushroom pudding and mushroom stuffed masala idli and baked products, swiss roll and choux pastry.

For textural character, the mean score was found to be lowest (3.7) in sauteed mushroom and highest (4.9) in mushroom omelette. The scores for overall eating quality ranged between 3.7 to 4.6 for sauteed mushroom, mushroom munchoori and choux pastry.

The best accepted products were mushroom munchoori, choux pastry, swissroll and mushroom pudding and it was found that there was no significant difference ($P \leq 0.05$) between these four products. Since both swiss roll and choux pastry were baked products, swiss roll was omitted and finally mushroom munchoori, choux pastry and mushroom pudding were actually analysed in the laboratory rather than by computation method to determine their proximate nutritive value and to report precisely the values on "as is consumed" basis. Because of time and expenditure on analyses all the products were not analysed and computed values could be accepted for routine use (Table-2). Among the three best accepted products analysed protein content was highest in pudding (27 g.) and lowest in Manchoori (11 g.) Choux pastry and high fat content of 60% followed by Munchoori 50% and pudding had lowest of 27.0 g%. Crude fibre content ranged from 0.4 to 6.3 g% 100 g. Choux pastry had highest energy of 560 K. calories and it was found lowest in mushroom pudding (506 K. cal). Acid detergent and neutral detergent fibre content was highest in choux pastry and lowest in mushroom pudding.

Nutrient composition of 100 g. ready-to-eat mushroom products were calculated on raw weight basis (Table-3). Protein content was higher in mushroom pudding followed by mushroom stuffed masala idli, mushroom omelette, swiss roll and choux pastry in descending order, protein content was lower in Mushroom Munchoori followed by mushroom chops and sauteed mushroom in order. Fat content was more in Mushroom Munchoori and sauteed mushroom but was lowest in mushroom stuffed masala idli, the differences in fat content was basically because of the type of recipe which calls for addition of high or low quantity of fat or oil. Range of energy, mineral and crude fibre content of the products were from 83 K. Cal to 250 K. Cals, 0.6 to 1.0, and 0.9 to 0.2 g% respectively. The carbohydrate content was found to be more (41.9 g) in mushroom stuffed masala idli and it was very low (0.1 g)

Table 2 : Percentage of Proximate Nutrients of Selected Ready-to-eat mushroom products (dry Weight basis)

Nutrients	Mushroom Pudding	Mushroom munchoori	Choux pastry
Moisture (g)	69.50	56.0	56.0
Protein (Nx 6.25) (g)	27.0	11.0	17.0
Fat (g)	27.0	50.0	60.0
Energy (K. Cal)	508.0	532.0	560.0
Ash (g)	9.5	9.8	3.5
Crude fibre (g)	6.3	0.4	1.4
Carbohydrate (g)	30.2	28.8	18.1
Dietary fibre ADF (g)	4.5	15.0	18.0
NDF (g)	13.7	15.5	19.4
Analysed Values			

Table 3 : Percentage Nutrient Composition of Ready-to-eat mushroom products (As is consumed)

Product	Amount of mushroom in Recipe (g)	Protein (g)	Fat (g)	Energy (K. Cal)	Ash (g)	Crude fibre (g)	Carbohydrate (g)
Mushroom curry	60.0	2.4	8.8	121.0	1.0	0.90	7.0
Mushroom with Noodles	30.0	4.1	5.7	210.0	0.7	0.5	25.0
Mushroom Pudding	30.0	8.0	8.3	145.0	0.9	0.4	10.8
Mushroom Masala Idli	20.0	7.4	3.0	210.0	0.6	0.4	41.9
Mushroom Chops	60.0	2.2	5.5	83.0	0.5	0.7	8.3
Sauteed Mushroom	70.0	2.25	20.5	210.0	1.0	0.3	3.0
Mushroom Omelette	30.00	7.3	12.3	145.0	0.8	0.1	0.1
Mushroom Munchoori	50.0	1.0	24.0	250.0	0.6	0.3	15.0
Swiss roll	30.0	7.0	4.32	200.0	0.9	0.2	33.0
Choux Pastry	30.0	6.0	15.4	224.0	0.9	0.3	15.0

Computed Values Based on Major Raw Ingredients (Gopalan, 1987).

in mushroom omelette.

Mushroom pudding is rich in protein, fat, energy and minerals which can be used as weaning food for infant and snack item for preschool children, recommendable for ulcer patients and convalescents. The product has smooth texture, may be easy to digest also, as steaming is one of the best cooking methods for nutrient retention and easy digestibility. Mushroom munchoori and pastry rich in fat and energy can be recommended for malnourished and under-weight children.

The present study indicates that post harvest studies like development of recipes with fresh mushrooms for acceptability could result in showing promising future to mushroom utilization. Financial assistance may further help to establish small scale biotechnical units for undertaking the cultivation of mushrooms as a socio-economic and nutritional improvement venture.

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Cashewnut Processing in Midnapore District of West Bengal : A Case Study

by

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Introduction

The cashewnut tree (*A. occidentale* Linn.) was introduced in India by Portuguese settlers in the 16th century from Brazil. Initially cashewnut cultivation was started in Kerala, Karnataka and Goa. Later on, it was extended to coastal areas of Andhra Pradesh, Orissa and West Bengal as a powerful resistant to soil erosion. The tree begins to flower in December and continues for about 4 months. The fruits are collected from February to June. Normally the yield is about one tonne per hectare and can be improved to 2.5 t/ha with better farm management practices. The kidney shaped nut is attached to the bottom of 'cashew apple' of 5-9 cm in length and has thin bright yellow skin. Its flesh is soft and juicy. The nut is in greenish-grey colour. The size of ripe cashewnuts varies from 30-50 mm in length, 20-35 mm breadth and weighs 3-20 g. Shell encloses a slightly curved white kernel covered by an astringent and non-toxic thin reddish brown skin or testa which guards against spoilage by fungus or worms. Thus intact peel improves storability of the kernel. A kernel constitutes 18-30 per cent by weight of air dried nuts.

In 1989, the total harvest of raw cashewnuts exceeded 2.5 lakh tonnes in the country. This has resulted in a record export of 44,857 tonnes of kernels valued at Rs. 360 crores (Giridhar Prabhu, 1990). The industry in India comprises units in the rural sector. At present, the total installed capacity exceeds 6 lakh tonnes per annum. The planning commission has evolved a strategy for the development of cashew industry till 2000 AD by giving importance to: demonstration of improved agrotechniques and post-harvest technology of cashewnut processing.

The general steps in cashewnut processing are: conditioning, nut drying (sun), roasting, shelling, kernel drying (oven), peeling and grading. Roasting of nuts introduces a characteristic flavour and taste to the kernels. It also improves the cell wall of the shell and facilitates maximum recovery of cashewnut shell liquid (CNSL).

Broadly there are two methods for roasting of cashewnuts viz. oil bath roasting and drum roasting. Flow diagram for both the methods have been given in Fig. 1.

In oil bath roasting the conditioned nuts

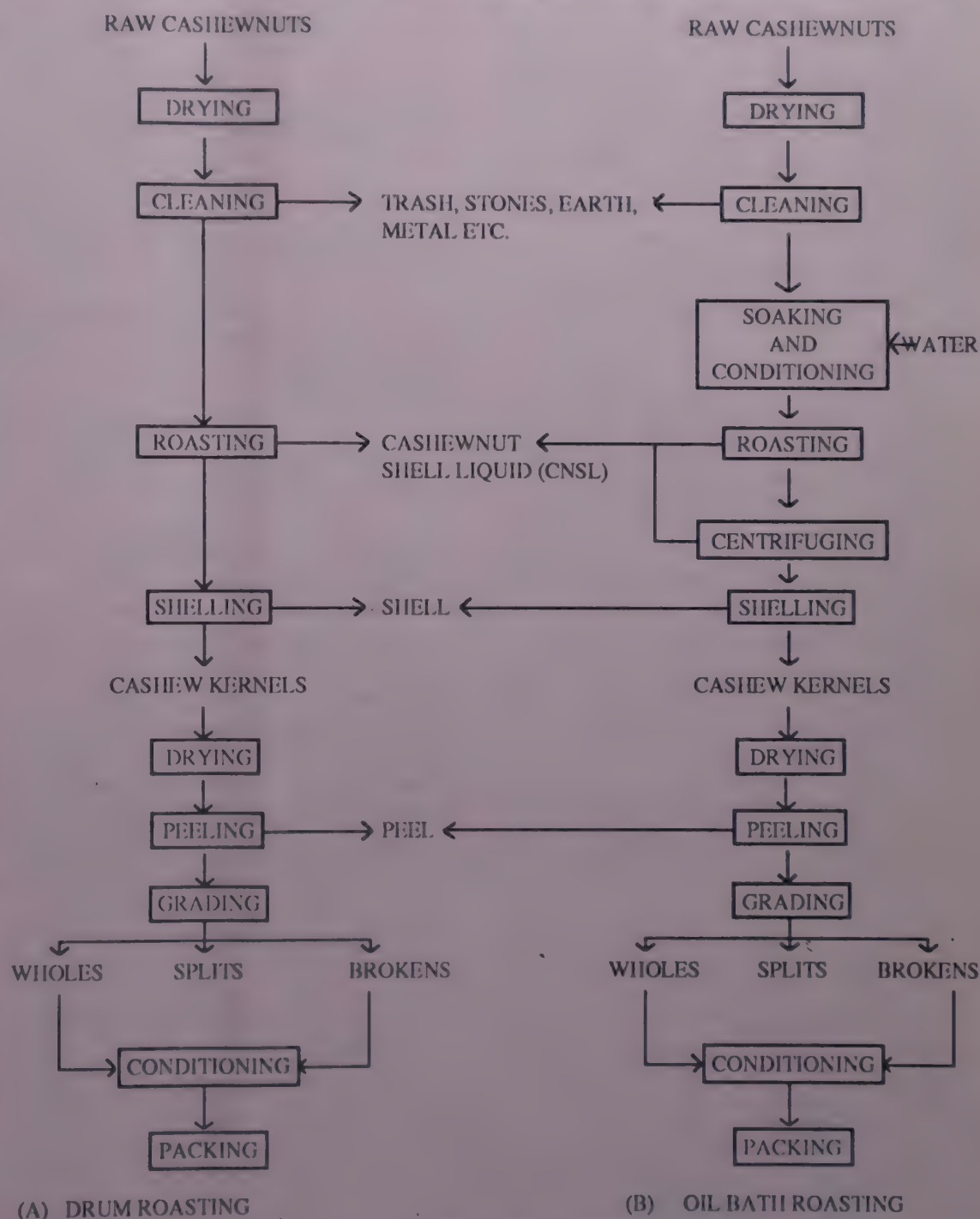


FIG. 1 FLOW DIAGRAM OF CASHEWNUT PROCESSING

are allowed to pass through a bath of heated CNSL maintained at a temperature of approximately 175-200°C for about 1-2 min. The roaster consists of a rectangular vessel with or without a semi-circular bottom in which there is either a screw or a belt conveyor operating inside the bath of the liquid (CNSL). It is estimated that 50-60 per cent of the CNSL is released in the process.

The nuts are then centrifuged to collect the residual oil adhering to the surface. The nuts are mixed with the ash and sent for shelling.

In the process of drum roasting the nuts are fed into a rotating drum which is heated initially to red hot sufficiently to allow the shell portion of the nut to ignite and burn. Once ignition starts no further heating is

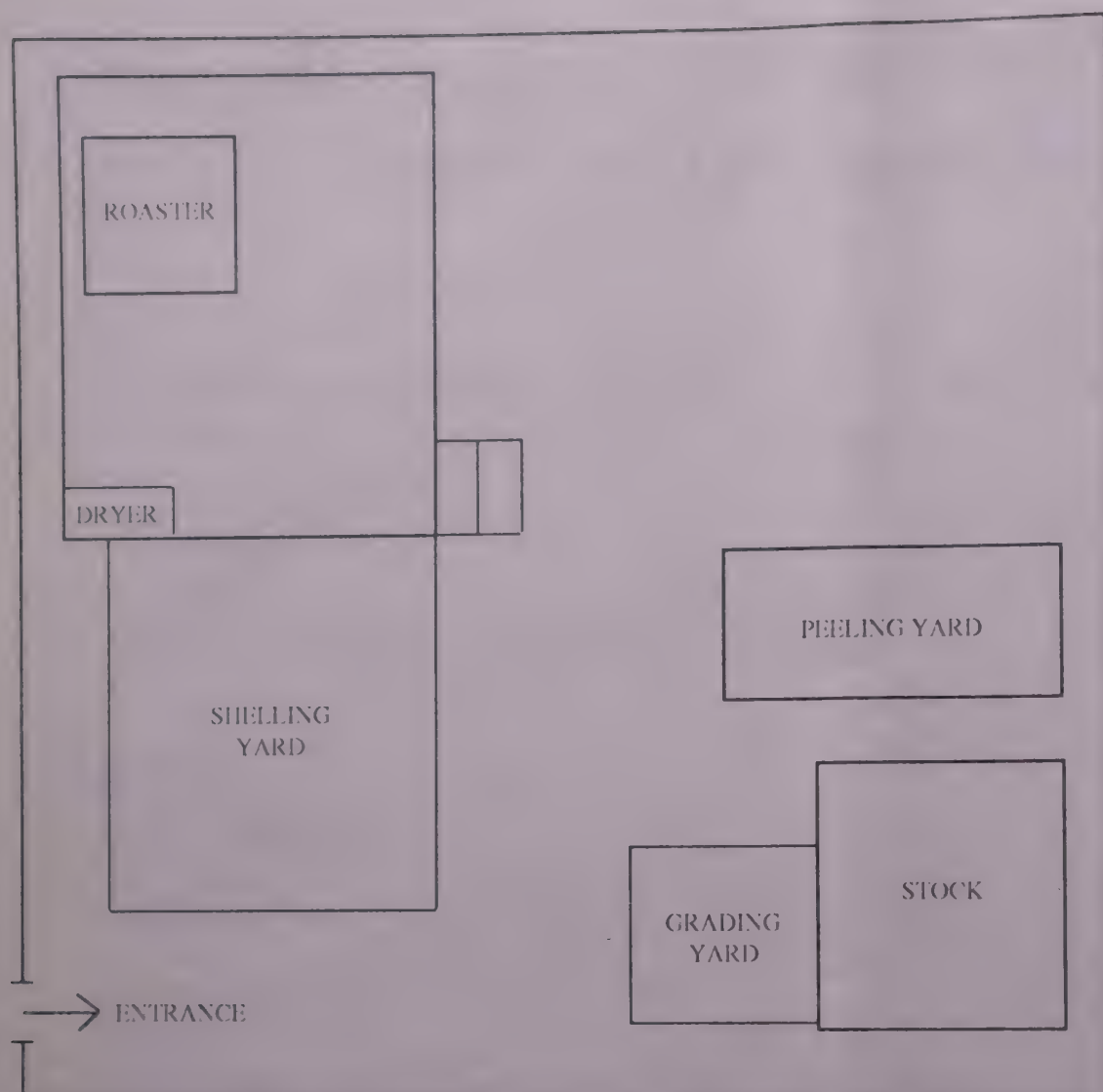


FIG.2 LAYOUT OF M/s BABA GUNTIARY CASHEWNUT PROCESSING FACTORY, CONTAI

necessary and the drum maintains the temperature on its own because of the burning of oil oozing out of the nuts. The temperature of the drum is fairly high. It is stated that in this method of roasting the shell becomes very brittle and rate of shelling and out turn of whole kernel is higher compared to other methods of roasting.

Case Study :

The Midnapore district of West Bengal is one of the major cashewnut producing and processing centre of the eastern part of the country. There are about 12 factories clustered in and around Contai (a Sub Division of Midnapore District). A case study was un-

dertaken to understand the difficulties encountered by the entrepreneurs in cashewnut processing. The layout of a typical cashewnut processing factory (M/s Baba Ghuntary Cashewnut Processing Factory), in operation, at village Chaudhary bard, P. O. Basantia, District Midnapore (W.B.) is shown in Fig. 2. The details of unit operations are described below.

Conditioning :

The nuts are cleaned through a screen to remove dust and foreign matter followed by washing in water at room temperature. The washing is done by dipping in a tank and then heaped on the floor for 24-72 hrs. with intermittent sprinkling of water. The quality of the final products is entirely dependent on this operation. Under - conditioned nuts yields less CNSL and more broken kernels whereas over - conditioning results in discolouration of the kernels.

Roasting operation :

Invariably, drum roasting method is adopted. Details of a typical drum type cashewnut roaster is given in Fig. 3. Roasted cashewnut shell is used as fuel in the furnace. about 40 kg of the shell is burnt for 30 min to achieve desired temperature of 600°C. The raw cashewnuts are fed into the hopper and simultaneously the inclined drum (roaster) was manually rotated at 80 rpm with the gear arrangement. In this operation 3 persons are engaged to roast 12 gunny bags of raw cashewnut (1 gunny bag consists of 80 kg) in 3 hours. On an average the residence time was observed to be 1.5 to 2.0 min. The burning cashewnuts were discharged at the discharge end on a perforated screen and collected with the help of a metallic spade. Water was sprinkled by a pipe to extinguish fire and to take out the oil. Oil is drained beneath the perforated sheet and collected through a cemented channel into a sump. The temperature of this collected nuts were observed to be 70°C.

Shelling operation :

The roasted nuts are thoroughly mixed and rubbed with the resultant ash of the burnt cashewnut shell to remove the oozed oil from

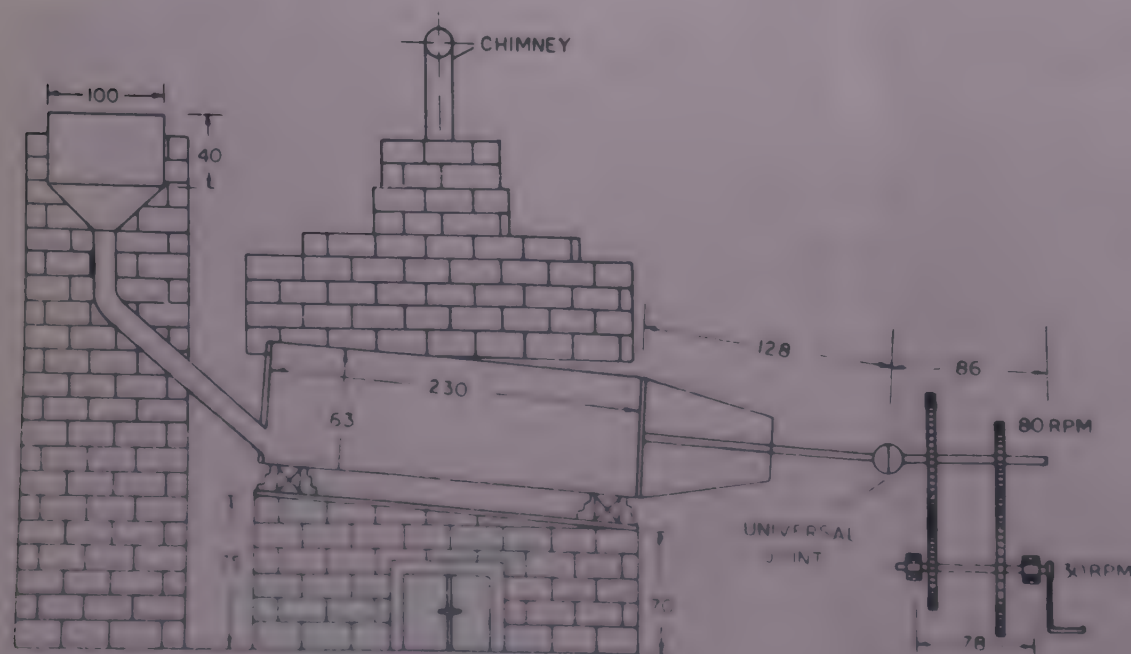


FIG.3 DRUM TYPE CASHEWNUT ROASTER

All Dimensions are in cm

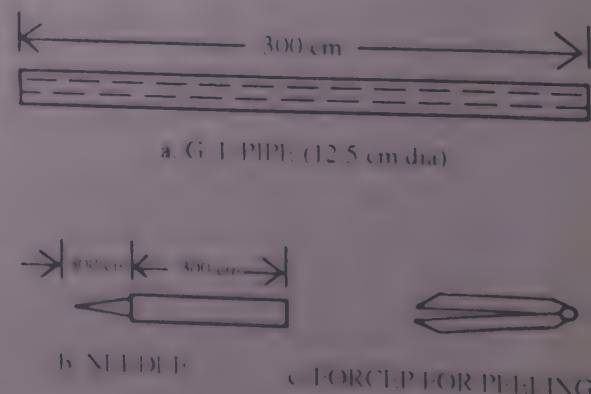


FIG.4 TOOL USED IN CASHEWNUT SHELLING

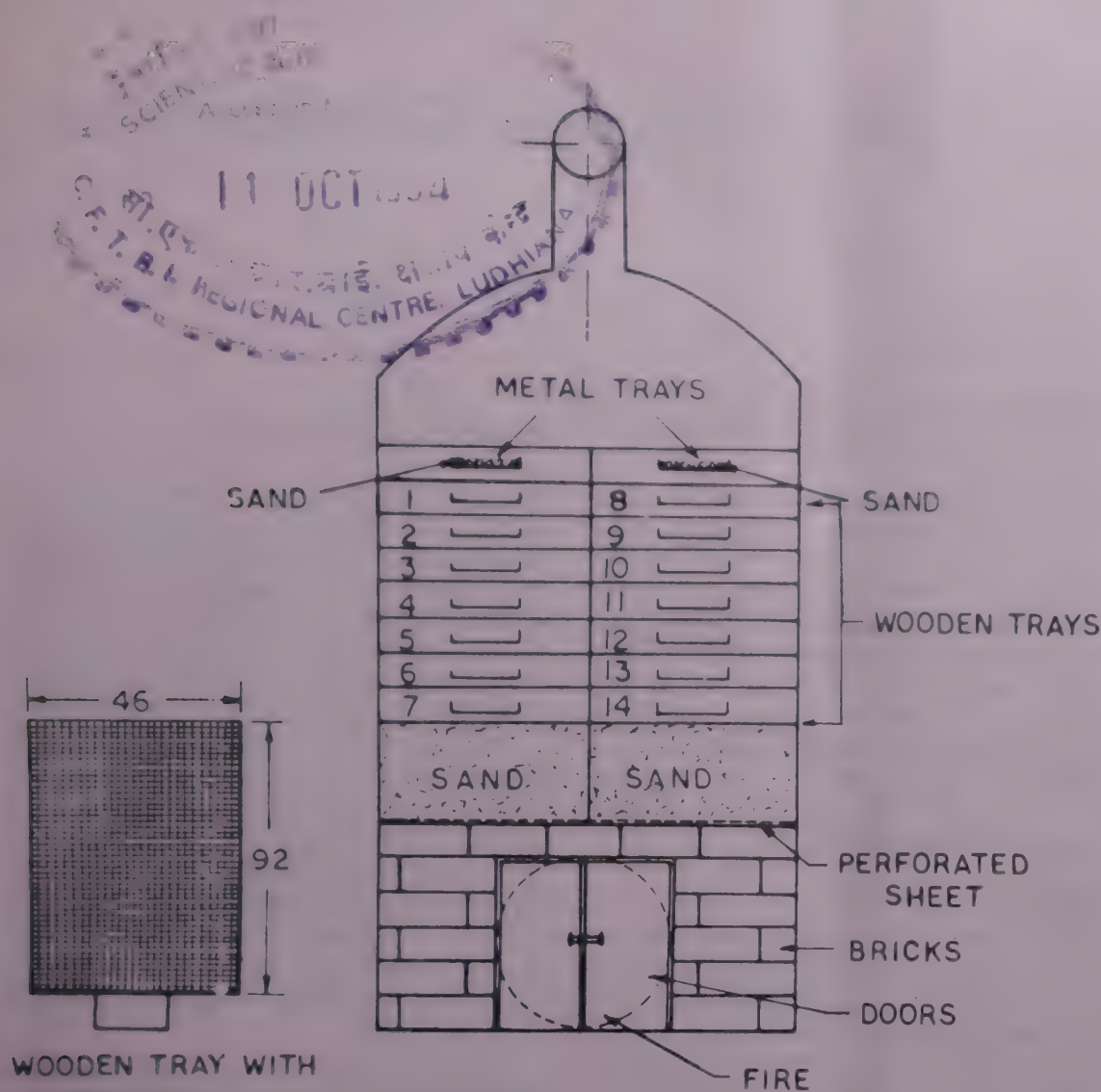


FIG. 5: TRAY DRYER FOR CASHEW KERNELS

All Dimensions are in Cm.

the surface of the roasted nuts. The shelling operation is labour-intensive, carried out manually with skilled labourers especially women (30 Nos.). The tools required for this unit operation are G. I. pipe (300 mm long and 25 mm in diameter) or wooden piece (200 mm long) and a needle as shown in the Fig. 4 (a,b). The individual roasted nut was placed alongside on a brick and gently tapped 2-3 times with a G. I. pipe. This impact force enables the nut to crack and the shell was separated with a needle into two halves for taking out the whole kernel. The average shelling rate observed to be 8-10 kg per worker per day (8 h).

Drying Operation :

A shell-fired tray dryer locally known as 'Borma' is shown in Fig. 5. The shelled kernels were evenly spread over perforated (20 mesh) trays of wooden frame of size 920 x 460 mm. The drier accommodates 14 trays in two columns. Each tray can hold about 10 kg of kernels. The top two trays and the bottom surface of the drier contains sand. The sand was used as a heat transfer medium because it absorbs heat and releases at a very slow rate. Thus the desired temperature of 80-90°C was maintained for 5-7 h. Trays are interchanged inside the oven for uniform drying. Dried kernels are heaped for a day or so before peeling.

Peeling Operation :

This unit operation is also carried out manually. The dried kernels are easy to peel and susceptible to break during the operation. Therefore, this unit operation has to be carried out with utmost care. The peel (red skin) is removed by rubbing between the fingers. If any unpeeled portion of the kernel remains, it is further separated with the help of a forcep (Fig. 4c). The peeled kernels are then graded into various trade names according to their size.

Grading Operation :

The peeled kernels were graded by the experienced persons manually under various commercial names viz. one jumbo, jumbo, double, american (mixed), special (split), baby chips (one fourth size) and kom (powder).

Packaging and Marketing :

The graded kernels are packed into hermetically sealed 10 kg containers in an atmosphere of carbon dioxide and transported to Calcutta by trucks.

Economics :

Based on the data obtained from the survey of cashewnut industry at Contai subdivision of Midnapore district of West Bengal, The economic feasibility and profit analysis has been worked out for an average sized cashewnut processing plant and presented

below :

1. Annual raw cashewnut processed 560 q
2. Recovery of cashew kernel from cashewnut 28%
3. Recovery of dried cashew kernel without peel 80%
4. Cost of machines required; roaster, oven ('Borma'), weighing balance, sealer and small tools (forcep, wooden hammer, needle) Rs. 30 000/-
5. Cost of land and building Rs. 60 000/-
6. Manpower employment
 - i. Skilled persons (3 Nos.) wages per person per month Rs. 1 200/-
 - ii. Unskilled person (30 Nos.) wages per day Rs. 20/-
7. Proportions of different grades of the finished cashewnut products as observed
 - i. Jumbo 18%
 - ii. Whole 38%
 - iii. Halves 32%
 - iv. Quarter 7%
 - v. Powder 5%
8. Cost of raw cashewnuts per quintal Rs. 2 000/-
 - (A) Fixed cost per year
 - i. Raw material Rs. 11 20 000/-
 - ii. Depreciation of machines (10 yrs) Rs. 2 700/-
 - iii. Interest of machines (@18%) Rs. 2 970/-
 - iv. Interest and depreciation on land and building (@18%) Rs. 10 800/-
 - v. Salary of staff Rs. 43 200/-
 - vi. Interest on rolling capital (per month) Rs. 2 800/-

Total Rs. 11 82 470/-

(B) Operating cost per year

- i. Salary of unskilled person Rs. 90 000/-
- ii. Maintenance @5% of m/c cost Rs. 1 500/-
- iii. Electricity charges @Rs. 125/- p.m. Rs. 1 500/-
- iv. Miscellaneous Rs. 10 000/-

Total Rs. 1 03 000/-

Total (A) + (B) = Rs. 12 85 470/-

Sale and receipts :

Total cashewnut produced
 $560 \times 0.28 \times 0.8 = 125.34 \text{ q}$

Grade	Quantity (q)	Rate (Rs./q)	Amount (Rs.)
Jumbo	22.56	18 000/-	4 06 101.60
Whole	47.63	15 000/-	7 14 438.00
Halves	40.11	12 000/-	4 81 305.60
Quarter	8.77	7 500/-	65 803.50
Powder	6.27	1 500/-	9 400.50
			Total Rs. 16 77 049.20

Profit Rs. 3 91 579.20

Profit percentage 30.46

Suggestions for future research :

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Preparation of Wine from Over-ripe Banana Fruit

by

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Abstract

An attempt has been made to prepare wine from over-ripe banana fruits. The juice recovery from over-ripe fruits was higher (67.6%) than that from normal ripe fruits (60.2%). The juice from over-ripe fruits had more TSS, reducing sugars, and less acidity and tannins than that from normal ripe fruits. The sensory evaluation studies showed that wine from over-ripe fruits was comparable to that from normal ripe fruits.

Introduction

Banana is a commercially important horticultural crop of Maharashtra State. The State, having an area of about 88,000 hectares, produces more than 40% of the total banana produced in India (Anon, 1986). Banana fruit is mainly used for table purpose. However, ripe or unripe bananas can be successfully processed into several products (Girdhari Lal et al, 1986). This fruit has a typical flavour and is a good source of minerals and vitamins. Like other fruits, banana fruits are perishable. The increased banana

production in particular season results in glut in market and the farmers suffer heavy losses due to reduced prices. Over-ripening of banana results in significant reduction in their market value. Many a time such fruits are fed to the animals. It is therefore, imperative to develop suitable technology for utilization of over-ripe fruits. An attempt was, therefore, made to extract juice and prepare wine from such fruits. The quality of wine prepared from these fruits was comparable to wine prepared from normal ripe fruits.

Materials and Methods

Normal ripe (just ripened, yellow coloured) and overripe (blackened skins) banana fruits were obtained from the local market. Bananas were peeled and homogenized in a Waring blender for about 2 to 3 min to obtain pulp. Potassium metabisulphite (100 ppm), was added at this stage to prevent browning and to check the growth of undesirable micro-organisms. Preliminary studies were carried out to optimise the conditions for maximum extraction of juice using different levels of pectinase enzyme (commercial prepara-

tion, PEC (Pecticenzyme concentrate) supplied by Microzyme Pvt. Ltd., Bombay) and different incubation periods at $28 \pm 2^\circ\text{C}$ (Table 1). Based on these studies, 0.2 per cent pectinase and 4 hours incubation time were selected for obtaining the juice from the pulp. The juice was separated by centrifugation at 5000 g for 20 min. The clear juice was used for the preparation of wine by slight modification of the method described by Kundu et al (1976). The TSS of the juice ($^\circ\text{Brix}$) was adjusted to 23°Brix using sucrose. The acidity was adjusted to 0.7% using citric acid. Diammonium phosphate (0.05g/100 ml) was added to the juice as a source of nitrogen and phosphorus for the yeast. The juice was then pasteurized by heating in water bath at $82-83^\circ\text{C}$ for 30 min.

Yeast (*Saccharomyces cerevisiae* var. *ellipsoideus*) inoculum was prepared 2 days in advance, using similarly extracted and pasteurized juice. This inoculum was added at 2% level to the pasteurized and cooled juice. The inoculated juice was incubated at 30°C upto 25 days. The fermented juice was clarified using 0.1% bentonite. The various steps in the preparation of banana juice wines are outlined in Figure 1.

Table 1. Effects of pectinase levels and incubation time on juice recovery of banana

Incubation condition	Juice recovery (%)
Pectinase level ^a (%)	
Control	36
0.1	58
0.2	62
0.5	62
1.0	67
S. E. \pm	1.84
C. D. at 5%	5.82
Incubation time ^b (hrs)	
0	45
1/2	51
1	59
2	63
4	67
8	68
S. E. \pm	1.51
C. D. at 5%	4.65

^aIncubation time 4 hrs

^bPectinase level 0.2 per cent

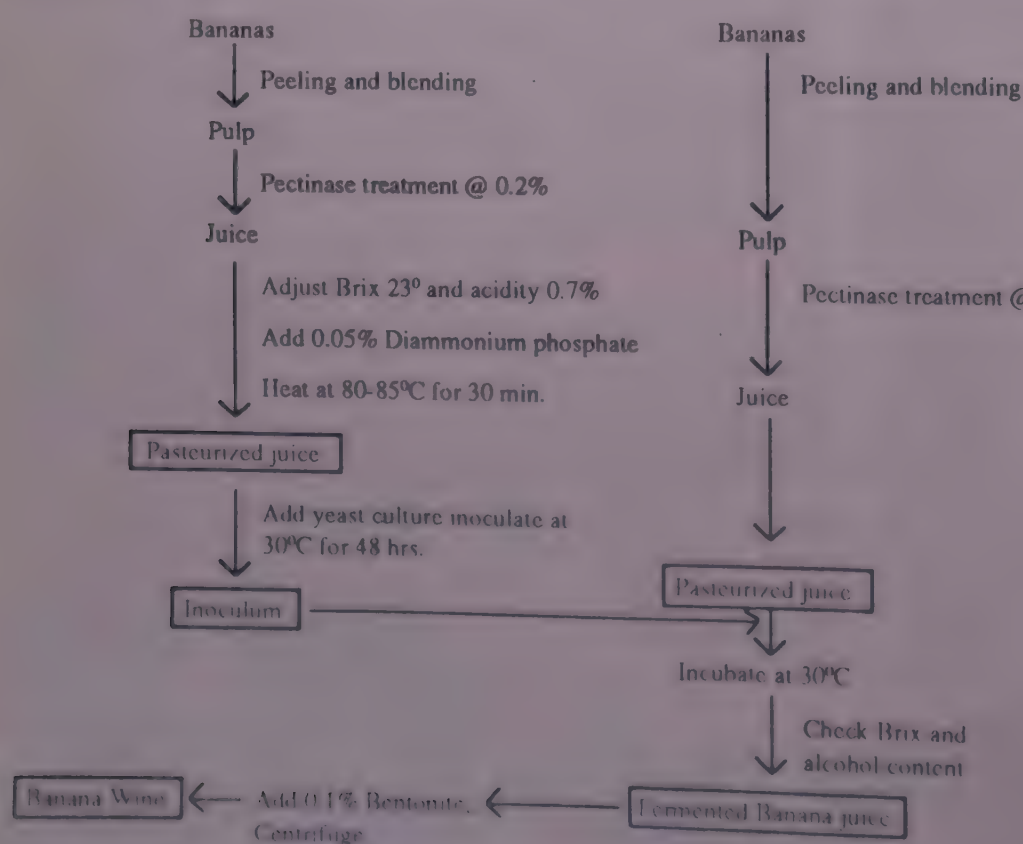


Figure 1. Flow chart for the preparation of wine from banana.

Table 2 Chemical composition of banana juice and wine

Characteristic	Juice		Wine	
	Normal ripe fruits	Over-ripe fruits	Normal ripe fruits	Over-ripe fruits
Juice recovery (%)	60.2 ± 4.6	67.6 ± 2.4	-	-
T. S. S. (°Brix)	20.33 ± 0.87	21.0 ± 0.2	10.2 ± 0.2	6.8 ± 0.6
Acidity (%)	0.47 ± 0.01	0.33 ± 0.04	0.88 ± 0.06	0.77 ± 0.03
Reducing sugars (%)	10.52 ± 0.05	11.90 ± 0.1	3.18 ± 0.16	1.25 ± 0.05
Tannin (%)	0.061 ± 0.004	0.050 ± 0	0.044 ± 0.002	0.033 ± 0.001
Total SO ₂ (mg/l)	-	-	67.10 ± 1.10	60.54 ± 0.06
Alcohol (v/v, %)	-	-	6.06 ± 0.06	7.39 ± 0.04
Overall organoleptic Score (out of 20)	-	-	15.00 ± 0.12	13.66 ± 0.34

Table 3 : Comparative production cost of banana wine

Particulars	Normal ripe fruits	Over-ripe fruits
Cost of 2 dozen fruits (Rs.)	10.00	4.00
Yield of pulp (g)	1200	1160
Yield of juice (ml)	720	780
Juice recovery (%)	60	68
(on pulp weight basis)		
Cost of added chemicals (Rs.)	1.00	1.00
Processing cost at the rate of 1/3 of cost of raw materials (Rs.)	3.65	1.65
Yield of wine from 2 dozen fruits (ml)	700	750
Production cost of 1 lit. of wine (Rs.)	21.00	9.00

The juice and wine were analysed for TSS, acidity, reducing sugar and tannin contents. The wines were analysed for SO₂ and alcohol contents and subjected to organoleptic evaluation.

The TSS content was determined using Erma hand refractometer. Titratable acidity, and total sulphur dioxide contents were determined by standard A. O. A. C. (1975) procedures. The reducing sugars were estimated by the volumetric method (Ranganna 1977) while tannins were estimated by using Folin-Dennis reagent (Swain and Hillis, 1959). The alcohol content in wine was estimated by using dichromatic reagent as described by Natu et al (1986). The organoleptic evaluation of wine samples was done by a panel of 11 judges on a standard 20 point score card as described by Amerine et al

(1967).

Results and Discussion

Banana Juice

The recovery of juice was more from over-ripe fruits (67.6%) than from normal ripe fruits (60.2%) (Table 2). The juice from over-ripe fruits contained more TSS, reducing sugars, and less acidity and tannins than the juice from normal ripe fruits. The higher levels of TSS and sugars in overripe fruits were obvious because of rapid conversion of polysaccharides into sugars during ripening. The decrease in acidity in over-ripe fruits may be due to the utilization of organic acids for the respiratory activity.

Banana Wine

The wine prepared from over-ripe fruits

contained less TSS, reducing sugars, acidity, tannins and SO₂ and more alcohol than the wine prepared from normal ripe fruits (Table 2). The organoleptic evaluation of wines showed that the wine prepared from over-ripe fruits was comparable to that from normal ripe fruits in colour, taste and astringency characteristics. The overall organoleptic score out of 20 was 15.00 for wine from normal ripe fruits and 13.66 for wine from over-ripe fruits.

The laboratory scale production costs of wine from normal-ripe fruits and over-ripe fruits were worked out on the basis of market prices of raw-materials, chemicals added and yields of juice and wine (Table 3). The cost of production of wine from over-ripe fruits was less than 50% than that from normal ripe fruits. The results indicate that cheap and acceptable quality wine can be prepared from over-ripe and poor quality banana fruits.

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Extrusion Cooking

by

Dr. T. Kuchroo
Dr. T. K. Food Consultants, Bombay.

The extrusion technique of thermoplastics that is commonly known in the plastics industry is now finding an ever wider application in the agriculture and food processing industry both for the production of new food-stuff as well as fodder.

The extrusion-cooking of vegetable raw materials consists generally in extruding a loose essential physico-chemical and hence qualitative changes in the raw materials processed. The process in question is implemented with use of an extruder-cooker, its main working assembly being a single screw situated in the machine housing and forcing the raw material through a special die block installed at the end of the screw.

At present, the extrusion-cooking technique is used for the production of a wide range of fancy consumption goods like snack crisps, chips, meat analogues, etc. and fodder for domestic animals as well as for pets and fish, and protein substitutes, e.g. urea fodder for ruminants.

The increasing popularity of the extrusion-cooking technique in the world's agriculture and food processing industry and its utility importance in particular has been prompted manufacturers into big industrial scale production.

The extrusion-cooking technique presents an excellent chance of utilization of raw materials that so far have never had a serious economic importance (e.g. broad bean). The market can be enriched with products of a new type and, more importantly with high quality substance of animal protein that is still in strong deficit. From the point of view of practice, it is very essential fact that this process can be promoted very easily because no high financial outlays are required. The apparatus involved is very easy serviced and can be applied for various purposes.

Raw Material Preparation

Raw material preparation for processing into extruded-cooked consumption products depends, first of all, on its constituents. Depending on their quality, they have to be comminuted, weighed and proportioned according to the recipe as well as mixed prior to pouring them into the extruder-cooker. If conditioning is required, a little water is added

prior to mixing.

Fig No. 1: Shows the diagram of the installation for thermoplastic shaping of vegetables protein starch preparations. In case of production of chips or other simple products the technological line is considerably simplified.

Extruded-Cooking Process:

The extruding-cooking process is taking in the final zone of the apparatus. As a result of the combined effect of the temperature (120-200°C) and pressure (upto 20 MPa), essential physico-chemical changes occur in the material while extrusion-cooking. When leaving the die block aperture, the material rapidly expands and the structure of the obtained products is very much like that of a honey-comb, the structure being shaped by bundles of fused protein fibres.

ity content during the production process. These are important in obtaining correct product quality. The high flexibility of both the production management and the precision of the control and adjustment of the thermal process is of paramount significance in constructing up-to-date extruders.

Power consumption tests of the extrusion-cooking process in a single-screw-extrusion-cooking indicate from 0.1 to 0.2 kwh is necessary to obtain 1 kg of extrusion-cooked product, excluding the cost of the raw materials and its preparation.

The estimated calculation, the total cost of the operation of the extrusion-cooker per one kilogram of finished product is clear proof of the high competitiveness of the extrusion-cooking process in comparison to other conventional methods of thermal processing of vegetable raw materials.

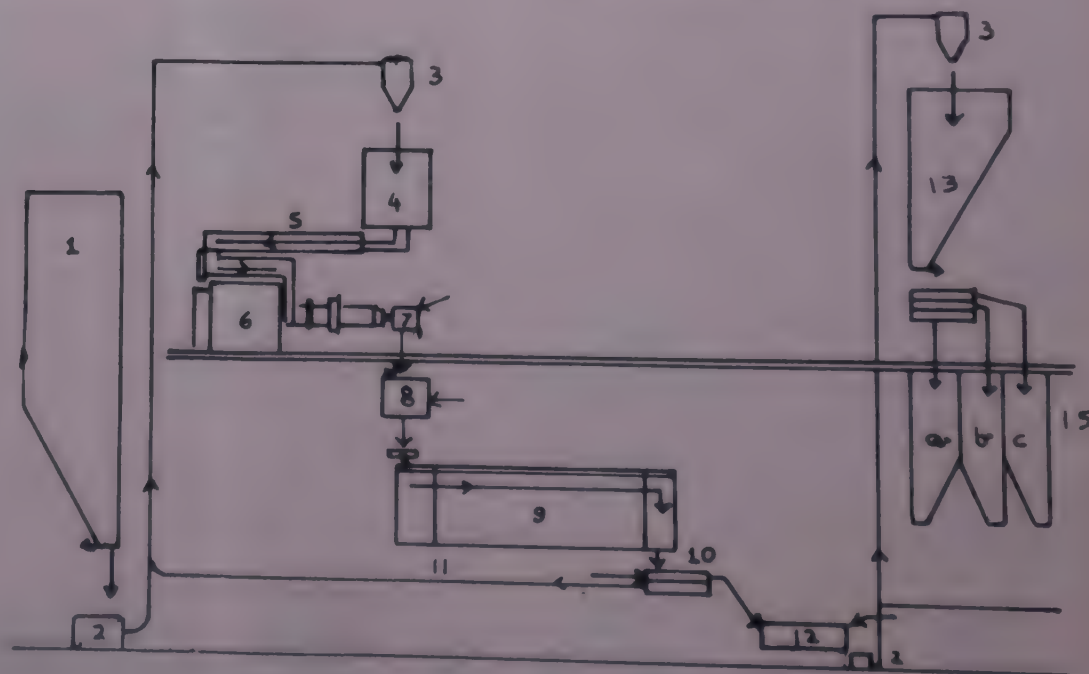


Fig. No.1 Diagram of the installation for the production of extrusion cooked products.
1. Raw material Bin 2. Pneumatic feeder 3. Collector 4. Bin with rotary discharge 5. Conditioning equipment 6. Extrusion Cooker 7. Rotary Knife 8. Comminuter 9. Drier 10. Sieve 11. dustrefum 12. Aromatization sprayer 13. Finished Production 14. Sieve 15. Finished product despatch bin

One extruder can be used for obtaining a wide assortment of finished products. However, the technology of obtaining each of these products exacts adequate composition of temperature pressure and material humid-

Shaping, Drying and Packing

Depending on actual needs and application, i.e. whether the extruded-cooked material is to be used as a semi-finished product or a finished product, the material leaving the

extrusion-cooker is subjected to respective shaping. The material is shaped by the Die.

The applications of the various kinds of Die Shapes enable the obtaining of many different forms of products like balls, rings, stars, alphabet letters etc. The length of the product is adjusted by regulation of the speed rate of rotary knife which is installed outside the nozzle.

A consecutive production step is subjecting the obtained material to drying, usually to about 90% of the humidity content and then to chilling. A tunnel dryer is usually used for its drying, the drying medium being air heated by gas or by steam to about 100°C.

For chilling, air of an ambient temperature (15-20°) passes through the apertures of the perforated tunnel dryer belt.

The last step of the production protein starch extruded-cooked foodstuffs, is their packing into plastic foil or paper bags. The storage life of extruded-cooked products is considerable and under correct storage conditions they can be stored for many months without any loss of their sensory or nutritive proteins.

Application Range of Vegetable Extrusion-Cooked products

At present, the extrusion-cooking process

is used for the production of foodstuffs, from the most simple, like chips or maize crisps to highly processed meat analogues. A continual increase in the application of extrusion-cooking technology is observed all over the world and the respective prognoses is very encouraging.

Among the most popular application lines for vegetables extrusion-cooked products are the following :

1. Production of breakfast cereals and fancy foodstuffs like snacks, chips, flakes, etc. based on corn raw materials, in different shapes and colour is the most simple for promotion.

2. Fodder for domestic animals (dogs, cats) and for home fish breeding. They absorb water slowly and do not rapidly decompose in the environment; as well as the concentrates for ruminants.

3. Production of protein texture products (mainly from soybean but not always) used in turn, for the production of meat processed foodstuffs, as a filling agent or as meat substitutes, i.e. hot dogs, cheaper sorts of perk products, etc.

4. Production of baker's additives to improve the sensory properties of baked products, and more recently for new products in the form of the so called 'flat bread'.

5. Production of instant beverages and baby food.

6. Production of multiconstituent and highly processed meat analogues.

7. Production of pasta products used in turn, for the production of ready-to-serve products, like fried snacks.

The author is a well-known Consultant for the food industry. This simplified article, in brief, throws further light on this unique technique of food extrusion which is finding increasing application in today's world -- Editor.

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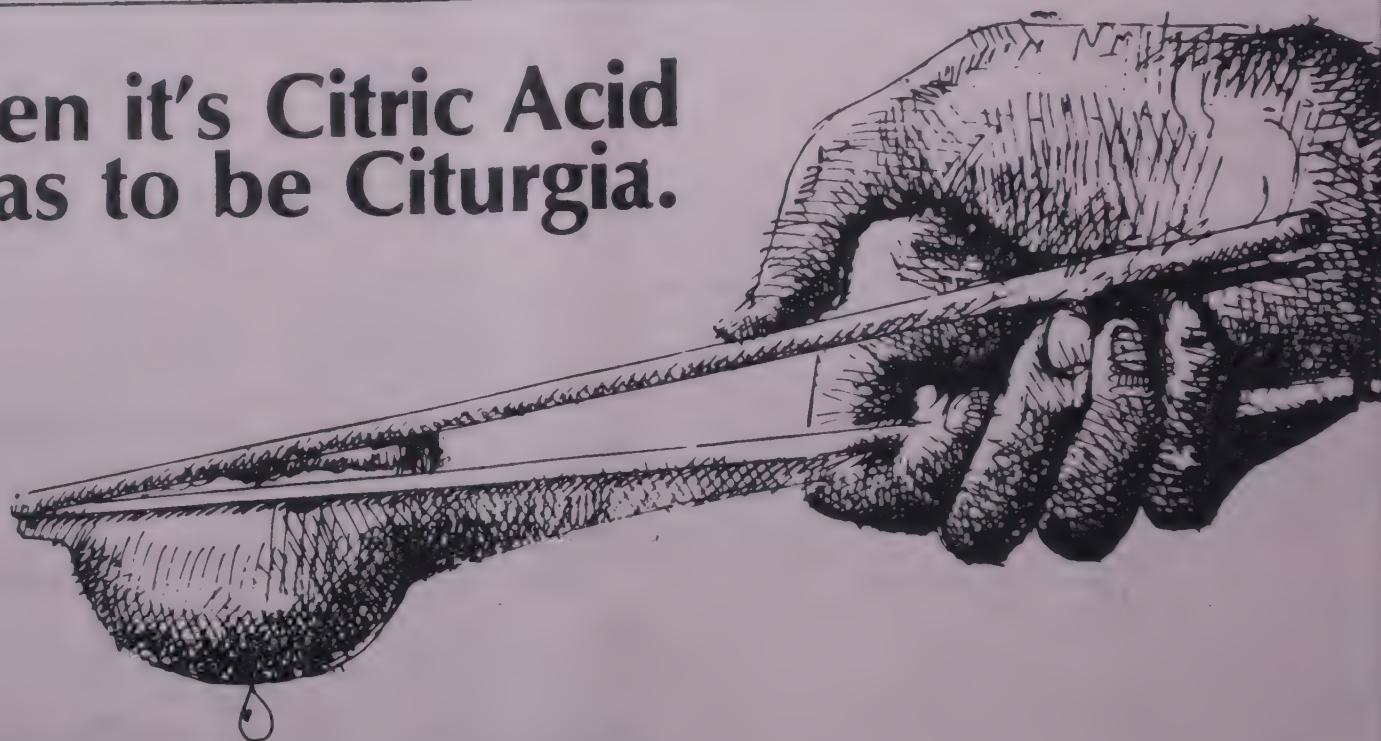
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NEWS & NOTES

CAPACITY OF BREWERIES LIKELY TO BE QUADRUPLED

More than one year after the cabinet relegated the move to delicense the beer industry to the backburner, the government is considering a policy envisaging quadrupling the licensed capacity of breweries to 20,000 kilo litres per annum.

A Cabinet note to this effect is being prepared on the basis of the views of the committee of secretaries, who were recently asked to examine the issue.

The current maximum capacity that is allowed on one license for domestic producers is 5,000 kl pa. In the new policy, this is proposed to be expanded to 20,000 kl, official sources disclosed.

The issue has been a matter of debate within the governmental ministries concerned. While the ministry of food processing industries, the operative ministry in charge of the subject, feels that the licensed capacities should be liberalised, other ministries, such as the welfare ministry were against the proposal.

It may be recalled that an earlier note on a comprehensive beer policy had proposed raising the licensing limit to 15,000 kl pa. The note had also proposed to allow fresh applications for beer licenses. The new note would also envisage lifting the freeze on fresh applications, which was imposed in 1991.

It may be recalled that creation of additional capacity for the manufacture of beer had been banned in 1974. By 1988 there were 32 units for the manufacture of beer with a total licensed capacity of 1.30 lakh kl pa.

In 1989, the government decided to lift the ban on the manufacture of beer after reviewing the policy and was subsequently flooded by applications. Of the 1,000 applications requesting grant of industrial licence for the manufacture of beer that have been received by the government between 1989 and April 1991, only 120 have been processed by the food processing industries ministry, say official sources. Of these, 115 have been issued letters of intent (LoI). Almost 90 per cent of these are those applications which include a 20 per cent foreign exchange component.

According to the current policy, any applications for capacities larger than 5,000 kl pa have to come through the Foreign Invest-

ment Promotion Board, with a high foreign exchange component, with 100 per cent EOUs getting preference. However, all such applications are given clearance on a case-to-case basis. This gives applications with high foreign exchange component an edge over applications by local producers.

It may be recalled that last summer, the government had mooted delicensing the beer industry. The move was scuttled after pending with the Cabinet Committee on Economic Affairs (CCEA) for several days, as it was not found to be "in tune with the social objectives of the government," sources said. It was perceived as the first step towards delicensing the entire alcohol industry.

Industry observers thus view the fresh proposal for creation of additional capacities in beer as an oblique move to decontrol the sector. This move is also expected to face heavy opposition on similar grounds.

Already the welfare ministry is understood to have raised objections to one of the proposals to provide incentives to setting up of manufacturing capacities in tribal areas, in order to catalyse economic activity. The welfare ministry has reportedly opposed such a proposal, said sources in the industry ministry.

TOXINS IN IMPORTED LENTILS

Vicia sativa, a legume known to contain naturally occurring toxins, was recently imported into India from Australia. Due to its semblance to 'Masur dal' (*Lens esculenta*), a legume commonly used in Indian diets, it has been used as an adulterant. On analysis, the imported legume traded as masur dal was found to contain B cyanoalanine, a potent neurotoxin. Considering the toxicity of the legume, a ban on its import has been imposed by the Government of India. Earlier studies had shown that yellow lentil imported from Turkey had also a neurotoxic principle. Import of this legume was also banned by the Government. To prevent such incidents, there is an immediate need to prepare appropriate guidelines not only for cultivation but also for the export and import of such legumes.

ALUMINIUM FOIL IN SWEETS

Coating sweet meats with 'silver foil' for better appeal is an age old practice in India.

The resemblance of aluminium foil to silver foil encouraged some unscrupulous traders to use aluminium as a substitute. A survey was conducted to find out the extent of adulteration of sweets with aluminium. 13 samples of silver foils from manufacturers and 68 sweet samples with foil were procured and analysed to test aluminium content. Three out of 13 samples of foils were made from aluminium and 16 out of 68 sweet samples contained aluminium foil.

Such information on newer food adulterants / contaminants would assist the Central Committee for Food Standards (CCFS) in taking decision to include such adulterants in the Prevention of Food Adulteration Act (PFA).

PANEL REPORT BEING IMPLEMENTED

The Union Secretary for Small Scale Industries and Food Processing, Mr. S. L. Kapoor, said recently that the Government had started implementing the recommendations of the Dr. Patel Committee which was appointed to find ways of boosting exports from agro-based industries.

He said the committee mainly dealt with the question of providing infrastructure for storing agricultural products, transporting and processing them. Railway wagons and port facilities had to be improved besides transferring technology in food processing and preservation to farmers.

The departments of food processing, commerce, transport and agriculture had been asked to analyse the problems in exporting food items, he said.

Banks had been asked to extend loans to food processing units with export potential and industrial units to advise farmers on storing and processing food, buying better seeds and agricultural inputs as the agricultural department was not in a position to take up agricultural extension work on a very large scale.

Claiming that export of agro-based products was already picking up fast, Mr. Kapoor said secretaries had been asked to find ways of speeding up customs clearance for agricultural products. The food processing department had kept pace with the commerce department in achieving the export target.

States had also been asked to set up nodal agencies for food processing industries and grants would be made available to the food processing units through them. The total foreign investment in small scale industries in the country was Rs. 6000 crore, of which food processing units alone accounted for Rs. 2200 crore. The growth of the small scale units would go up from six per cent last year to eight per cent this year.

Globalising of the economy and the GATT agreement would not have any adverse impact on the small scale units and several surveys conducted by the Government had revealed that exports had increased from Rs. 17,000 crore to Rs. 25,000 crore in 1993-94, he said.

FOREIGN DISTILLERS COMING FOR TALKS

With the price of molasses continuing to rule at Rs. 4,500 per tonne and the possibility of influx of foreign liquor in the near future, the potable alcohol industry is planning to switch to grain-based spirit within a year.

The change from molasses to grain-based alcohol manufacture is expected to occur sooner than planned as the industry is undergoing a transformation to improve quality, cut costs and penetrate new export markets, say industry sources.

The seriousness of the industry's intent to switch over to non-molasses-based alcohol production has attracted several well-known foreign distilleries and distillery equipment manufacturers for discussions with the industry.

These international firms include Alko of Finland, Dansac Fabricker, Vogel Bush of Austria, Rafael Kartzen of the US, Star Cosa of Germany and Lallemand of Scotland. Several other companies and experts from reputed institutions have been invited for a technical seminar organised by the All India Distillers' Association.

The Indian-made foreign liquor (IMFL) industry is also worried about competition. Some of the leading IMFL producers have already tied up with well-known international liquor giants which are planning to grab the premium market.

There are also fears that the Government may reduce import duty on foreign liquor in the next budget. Industry sources feel that the domestic manufacturers cannot hope to be protected for long now. Assuming that the duty is reduced from 350 per cent to 100 per cent, a 750 ml bottle of whisky will be available around the same price as the domestic liquor. With whisky accounting for only 10 per cent of the demand for alcohol, foreign firms are eyeing the lucrative Indian market.

The potable alcohol manufacturers are now seriously planning to improve liquor exports from the current level of Rs. 24 crore to at least Rs. 60 crore this year. Industry sources say that with concerted effort, Indian liquor could make a significant dent in the cheaper price segment of the international market. Rough calculations show that Indian liquor could sell for as cheap as \$ 1-2 for 750 ml compared to an average of \$ 30 in the case of Rum, say sources.

The industry feels that to become more competitive the first step will be a changeover to alternate substrates like wheat, rice, sweet sorghum, barley, corn and potato. Before the decontrol of molasses, the cost of production of alcohol ranged from Rs. 2-4 per litre while alcohol from grains cost about Rs. 9 per litre. However, after the decontrol, production costs are nearly Rs 20 per litre, according to AIDA.

Capacity utilisation fell to an average of 20 per cent following decontrol. Production is, however, expected to pick up this year from 1,000 million litres in 1992-93 to over 1,200 million litres. Total capacity is 2,440 million litres.

ASIA'S DEMAND FOR BEEF TO DOUBLE

Asian demand for imported beef is forecast to more than double by 2003 AD spurred on by strong growth in Indonesia and Thailand, an Australian industry group said.

The Kimberley Beef Industry Development Team, set up by the Western Australia Agriculture Department in 1993, forecast Asia's demand for beef will jump to 1.61 million tonne a year by product weight from the present 793,100 tonne.

Japan is expected to remain the largest importer of beef taking in 726,000 tonne a year followed by Korea with 337,000 tonne, it said in a paper at a Darwin farm conference.

Indonesian demand is forecast to rise to 98,000 tonne from 19,000 and Thailand's to 61,000 from virtually zero.

Australia exported 788,000 tonnes of beef and veal in 1993/94 worth AS\$3 billion from total beef production of 1.82 million tonne, the Australian Bureau of Agricultural and Resource Economics (ABARE) said.

Deborah Cope from the Office of Northern Development said demand for beef will rise along side disposable incomes in Asia and boost demand for other Australian agricultural produce.

The Australian Meat and Livestock Corp's managing director, Bruce Standen, said continued growth in Japan would spur on the local meat industry, but added that the live cattle trade to Asia also offered great poten-

tial.

Standen said the growth rate of the live cattle trade in 1993/94 was exceptional, increasing by 56 per cent to 257,139 head and value by 55 per cent to A \$ 110 million.

R & D ADVISORY CELL FOR FOOD PROCESSING TO BE SET UP

The government has decided to set up a Research and Development Advisory Council to promote research and development (R & D) activities in the food processing sector. The council will consist of food scientists and experts from the processed food sector and it will coordinate and direct research activities being carried out in a number of technical institutes and industries in food processing area and also decide the type of research that has to be taken up and priorities to be laid.

This was stated by the Minister of State for Food Processing Industries, Mr. Tarun Gogoi to the members of consultative committee attached to his Ministry. One of the thrust areas for the council will be development and standardisation of traditional foods.

Besides this, it will also scan the technologies available in the food processing sector and see if they are adoptable in the Indian context or not, he added.

Members were also informed that the Ministry of Food Processing has prepared a plan for information dissemination to the grass-root level.

Under the plan the Ministry will very soon come out with a number of video capsule on various type of information -- availability of raw material, infrastructure and technologies. These capsules will be displayed at the districts industries centres and rural food processing centres. This will help in transfer of technologies to the grass root level.

Keeping in view the need to develop technologies suited to Indian raw materials and requirements in of Indian consumers, the Ministry of Food Processing Industries had decided to set up a food engineering centre at Mysore. This centre will make techno-economic assessment of processed foods, assist in test-marketing of new products, generate a data base on infrastructure and raw materials availability.

It will also provide equipment facilities for new industries being set up and serve as engineering consultant, he added.

The centre will have a pilot plant complex food engineering laboratory. Modern design centre, a priority electronic shop and process instrumentation and automation laboratory, Mr. Gogoi said.

COMPANY NEWS

BHARAT STARCH

Bharat Starch Ltd., a Thapar group company, is negotiating with Commonwealth Development Corporation and Asian Finance and Investment Corporation to raise equity and debt for their 130 crore citric acid plant in Gujarat.

The company has also made plans for launching a publi-cum-rights issue of Rs. 54 crore to mop up resources for the project. The project is being put up in technical collaboration with Vogal Busch of Austria and is likely to be on stream by March 1996. The citric acid plant will have a capacity of producing 20,000 tonnes of citric acid per year.

The company will have to take up minor investments and changes to introduce this new product line. The citric acid plant is being put up with sophisticated equipment which will involve a lot of automation.

As part of the backward integration, the company plans to set up a corn milling complex adjacent to the citric acid plant. While a major part of the starch will be used for the citric acid plant, some will also be marketed to other companies.

RBL / STROH

The first of the foreign beer brands, Stroh, is slated to hit the Indian market in September, 1994. The beer to be marketed in 500 ml cans, will be priced at Rs. three more than a bottle of beer (650 ml), which is priced at Rs. 28 in the Bombay market.

Stroh beer will be produced and marketed by Rajasthan Breweries Ltd. (RBL) in India under a licensing agreement with Stroh Brewery Company of Detroit, US. This is only the second licensing agreement entered into by the 145-year old Stroh Brewery, the other being with a Canadian company. RBL will initially launch two brands, Stroh's and Stroh's Super Strong, in cans, according to Mr. Johan Stroh III, director in the US company. Within a year, the company proposes to expand its range of beers to include other variants like diet beer, light beer, ice beer, draft beer and non-alcoholic beer.

Canned beer is making a re-entry in the Indian market after a gap of nearly a decade. The UB group's first attempt to launch can beer failed to take-off because of the exorbitant price and use of steel cans which

is not conducive for storing beer over a long period. Stroh beer will be sold in aluminium cans. RBL will initially importing the cans at an import duty of 80 per cent, till its associate company, Asian Consolidated begins making cans at its Rajasthan factory by the end of the year, according to Mr. R. C. Jain, chairman of RBL.

According to Mr. Stroh III, canned beer has many advantages over bottled beer. Apart from being convenient and easy to handle, cans also chill faster than the conventional bottle and save energy in terms of transport and refrigeration, he added. Mr. Stroh III, who was in Bombay recently, spent an evening pub-hopping and found Indian beer good but lacking in consistency.

The 55 million cases beer market in the country, is expected to experience a shake-up with the launch of Stroh beer. The world's largest private beer company, Stroh, expects to market 3.5 million cases in the first year of operation and grab 10% of the Indian beer market, according to Mr. Glyn Partridge, director of sales and marketing, at Stroh.

The RBL brewery, designed by Danbrew of Denmark, has a capacity of 1.65 hect litres and set up at a cost of Rs. 65 crore. Asian Consolidated, set up at a cost of Rs. 125 crore, has a capacity to make 590 million cans per annum.

SSL

The cash-rich Sri Sarvaraya Sugars Ltd. (SSL) has taken up a major modernisation plan at its bottling plant near Rajamundry in Andhra Pradesh aimed at boosting the capacity for existing Parle softdrink brands and producing coke drinks as and when launched. The company is one of the eight of nine franchises of Parle operating in the state. It has another bottling plant in Kammam district. The company is part of the Rs. 100 crore Sarvaraya group with interests in textiles and trading.

The managing director of the company, Dr. S B P Rammohan Rao said recently that orders have been placed for importing a sophisticated bottling plant and machinery from KHS of Germany at a cost of Rs. 10.5 crore. He expected the new plant to be ready for operation in March next. The import cost is to be funded with Rs. 2.5 crore of internal

accruals besides by way of foreign currency loan and term loan from ICICI.

The high speed plant will have a capacity to make 600 bottles of aerated drinks per minute. The bottling line with extensive automation will cover from uncasing to casing operations. It will have proportionate mixer filler and all other machinery. The plant will also have the flexibility to produce in higher capacity upto two litres and to use PET bottles against the conventional glass bottles.

As part of the revamp, the existing non-aerated line with a capacity of about 140 bottles per minute is to be scrapped. Instead, the current aerated line of 280 bottles capacity will be used for making non-aerated drinks like Maza.

Dr. Rammohan said that Coke wants the franchise to install a new machinery costing about Rs. one crore for bottling its drinks. Coke also wanted SSL to start bottling by November.

When SSL revealed its major upgradation plan for Rajamundry plant, Coke preferred to wait for a couple of months more to utilise the facility. While KHS of Germany, an expert in the field has a collaboration with Larsen and Toubro to manufacture proportionate mixer, SSL has decided to import the entire bottling line in order to save time. It can also avail of a concessional duty of 20 per cent on the project import against the normal 35 per cent.

Dr. Rammohan said the company has gone in for major upgradation of the bottling plant in view of the promising future for fruit processing industry and soft drinks.

GOLDIN (INDIA)

'Goldin' (India) with U. S. based collaboration supply high-tech separation range of highly specialized machinerys including Screen-air Separators, Destoners, Gravity-Separators, Impact Hullers, Pneumatic Aspirators, Air-Classifiers etc., used on Soyabean, Sunflower, Groundnut, Rapeseed, Spices like Cumins, Coriander, Black pepper, Fennel, Celery, etc., Rice, Wheat, Pulses, etc.

The company is backed with decades of rich experience of highly qualified technocrats in design, manufacture, erection and commissioning of plants and bulk material handling equipment on turn-key basis, and serving the various fields such as : Ground-

nut / Soyabean cleaning and silo storage; Sunflower preparatory, dehulling and oil milling; Groundnut decortication and oil milling; Whole spice cleaning & grading; Seed processing for higher germination quality seeds.

Organizations such as N. D. D. B., Oilseeds Growers Federations of Gujarat, Maharashtra, Karnataka, Madhya Pradesh and Andhra Pradesh, Tamilnadu Agro Industries, Prestige Soya, Premier Extractions, A. V. Thomas, Brook Bond (India), VXL India, Unjha Spice Co., Swastik Masala, Pioneer Seeds, Nath Seeds, I.D.M.C., etc. have been served by Goldia (India).

VIDYA DAIRY

Vidya Dairy set up by the National Dairy Development Board, first of its kind in the country and probably in the world was inaugurated by Mr. Chhabildas Mehta, Chief Minister of Gujarat at Anand.

The Dairy has been established to provide an opportunity to students who have undertaken third year of B. Tech (Dairy Technology) Degree Programme with a view to give direct experience of modern dairy practices. This includes plan operation and maintenance, quality control, marketing, purchases, stores management and accounts management.

The Vidya Dairy is conceptualised by Dr. V. Kurien, Chairman, NDDB of a modern training dairy plant, equipped with latest technical facilities, which is run by students under the guidance of experienced officers, and yet is commercially viable. In such a factory, the students would receive excellent all round in-plant training.

The set up at Anand dairy has a capacity of milk intake of 1 lakh litres milk a day and also equipped to produce packaged pasteurised milk, ghee, processed cheese, ice-cream and UHT products. The main product is pasteurised standardised milk packaged in 500 ml pouches. The dairy can pace 60,000 litres a day.

On this occasion, Mr. Chhabildas Mehta, stated that a tax structure of a state should not be such that it hindered the development of trade and industry. He said that the state finance department was examining a proposal to ensure smooth development of milk co-operatives in Gujarat. Due consideration will be given to the proposal when it would come before the cabinet, he added.

ALPINE SOLVEX

Alpine Solvex, which is a major player in the solvent extraction market, is entering the highly lucrative area of high-protein soyameal business. The Indore-based company is now

poised to consolidate its position with the setting up of a new 1500 tpd soybean meal plant in Neemuch, MP.

The unit will be the largest integrated extraction plant in the country. The average size of domestic extraction plants so far has been between 400-600 tpd, which is quite small as compared to similar plants in the US which have an average capacity of 2500 tpd and those in Brazil and Argentina which have an average capacity of 1400 tpd.

Alpine Solvex, which is the largest manufacturer and exporter of soyabean meal, will double its export earning to Rs 210 crore for 1994-95, with its foray into the area of high-protein soyameal. Alpine achieved the status of 'export house' in 1992-93 and status of 'trading house' in 1993-94 with an export turnover of Rs. 100.5 crore.

The soya extraction industry today is a picture of excess installed capacity and under-utilisation. Capacity utilisation has stagnated at 40-45 per cent. However, industry sources defend the higher capacity by pointing to the large export market. India has replaced China as the major supplier of soyabean meal in the Middle East and Far Eastern Markets.

UAE, Kuwait, Qatar and Oman source 100 per cent of their soyabean meal requirements from India. However, in Saudi Arabia and Jordan, the Indian exporters have not been able to make a clean sweep. This is because of the preference in these markets for high-protein soyameal with 48-52 per cent protein content. Indian soyabean meal with a protein content of only 44-46 per cent falls short of this requirement.

It is this market that Alpine plans to tap with its new hi-pro soyabean meal at its Neemuch plant. The US SBM sells at a premium of US \$ 30-45 over the Indian soyabean meal's sale price because of its protein content and sources at Alpine hold that Alpine too can command a higher price per tonne after its new plant goes on stream later this year.

The company has placed orders with Buhler of Switzerland and DeSmet of Belgium for machinery for the production of the higher quality SBM. It has also started packing its output in polypropylene bags instead of jute bags to maintain the quality of the product. Alpine will also be launching its branded soya oil, Gold Medal, by October, this year.

The real challenge for Alpine, according to market watchers, will be sourcing of raw material since the soya extraction industry is already overcrowded. Company sources admit to this problem and are pressing the government to permit the import of soya seeds.

IDL

"Speyroyal Scotch" is to be shortly introduced by the Indo-Irish venture, International Distilleries India (IDI) Ltd., in the market in another two to three months time and would surely provide a run for Shaw Wallace's premium Scotch brand "Antiquity".

IDI also launched the first cream liquor brand in India, "Kellys Original Irish Cream" coinciding with the launch of the legendary "Smirnoff" vodka in Calcutta.

Besides the "Speyroyal" a whole range of world famous spirits which are owned by the International Distillers and Vinters, a \$ 5.3 billion subsidiary of the \$ 15 billion Grand Metro Group, are to be introduced over a phased manner within this century. It includes brands like J & B Rare Scotch whisky, Gilbeys Gin, Malibu, Black Velvet whisky, Metaxa Brandy, Baileys Irish Cream and Cinzano.

Speaking to newsmen in Calcutta recently, Mr. Deepak Roy, Director of IDI said that there is enough room for new premium brands in the Indian market and there is no question of threatening the market of established brands.

Speyroyal Scotch would be imported from Scotland in bulk and bottled in India. Though the pricing has not been finalised yet, Mr. Roy said that it would be preferably around Rs. 850 per bottle of 750 ml. The current international price of Speyroyal is around Rs. 1,000 per bottle.

Incidentally in the 40:60 Indo-Irish joint venture, IDI, has an initial investment of Rs. 40 crore, of which Rs. 20 crore has come from commercial borrowings.

With Smirnoff, IDI plans to capture 25 per cent of the vodka market in India and market around 100,000 cases in another two to three years time. By the turn of this century IDI plans to produce 500,000 cases of Smirnoff for the Asian market as a whole. IDI is the sole proprietor of IDV brands in the whole of Asia and all marketing contracts of IDV in Asia would henceforth be exported from India. Incidentally India is the seventh country in the world to manufacture and market different internationally acclaimed IDV brands.

Smirnoff is expected to cater to the premium vodka market and it is priced around Rs. 290 per bottle of 750 ml and the company officials are confident of successfully marketing it even though other vodka brands in the market are priced much lower. Meanwhile Kellys is priced at Rs. 450 per bottle in Calcutta.

SOM DISTILLERIES

SOM Distilleries Ltd., which now pos-

sess an integrated liquor manufacturing plant is poised to grow in dimension by promoting a beer manufacturing public limited company in the name of SOM Distilleries and Breweries Ltd., for manufacturing international standard beers.

The beer plant is one of the best plants in India having the most modern technology and automation. The company is heading for diversification and is poised to enter in the field of electronics and specialised communication.

SOM Distilleries Ltd., the flagship company of the SOM group, one of the largest distilleries from Central India has recorded good growth rate and has made a mark for itself among the established IMFL manufacturers in the country.

Headquartered in Bhopal with a plant at Schatganj in Raisen district of Madhya Pradesh, SOM Distilleries uses modern distilling processes and technologies. The uniqueness lies in the distillation process where spirit is made out of fermentation and distillation of molasses, grains such as Rye, Barley, Corn. This results in the product having a smooth, mellow and tingling taste. All of Som Distilleries products namely Whisky have maturity content of four years in comparison to that of two to three years of other available products.

The Schatganj Plant has an installed capacity of 1.20 lakh litres per day (LPD) of IMFL and rectified spirit, extra natural alcohol (ENA) and country liquor products.

SANJAY GROUP

The Sanjay group of companies comprising United Industries, Sanjay Raja Finance and Investment Ltd. and Sanjay Raja Foods Ltd., is planning to expand its activities in the packaged foods business, and diversify into the mineral water business.

Started with technology borrowed from Italpast of Italy, the company currently has a combined monthly capacity of 300 tonnes at its two existing units. A public issue is slated for the end of the year to raise approximately Rs. 12 crore (Rs. 8 crore from the public and term loans worth Rs. 4 crore) to finance the expansion plans.

The company plans to have another plant with a monthly capacity of 1500 tonnes. Managing Director, Venkateshwar Raja said that the company's range of noodles, semia and papad have the USP of having no preservatives. Having already made a presence in the Southern markets, the company plans to enter other markets beginning with Maharashtra in September.

ANMOL DAIRY

Anmol Dairy Ltd. is setting up Rs. 1,250

lakh new dairy plant for processing two lakh litres of milk per day to manufacture pasteurised milk and valued added dairy products viz. cheese, butter, skimmed milk powder, ghee etc.

The company has been promoted by Union (India) Ltd., Mr. Harshad N. Patel, Mr. Amar H. Patel and Mr. Dhruv H. Patel. The company is setting up the milk processing unit at village Kadi, a backward area of district Mehsana, north Gujarat which is 45 kms from Ahmedabad.

Mehsana is a centre with abundant milk availability. The plant and machinery will be procured from reputed manufacturers like Alfa Laval (India) Ltd and the company shall commence commercial production very soon.

The company has an installed capacity of two lakh litres of milk processing per day. The company also plans to manufacture Baby food and chocolates at a later stage. The company intends to market its products under the name "Anmol Dairy". Initially, the company will market its products in pouches and tankers to wholesalers in Bombay and Gujarat. The company plans to export Ghee, Cheese, Skimmed Milk Powder, etc. to Middle East and the Far East countries.

The project has been appraised by Union Bank of India. The company hopes to achieve

a net sales of Rs. 34.39 crore in 1995 on nine months working and this will increase to Rs. 55.99 crore in 1996 and Rs. 65.02 crore in 1997. The company hopes to earn a net profit of Rs. 171.02 lakh, Rs. 353.45 lakh and Rs. 427.40 lakh respectively.

WINDSOR FOODS

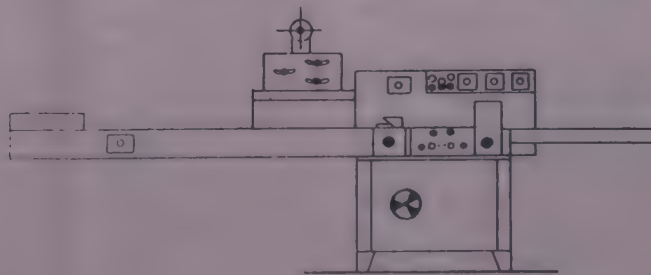
Windsor Foods Ltd., the leading biscuits manufacturing company will introduce a new brand of biscuits, namely "Teething Rusk" for small children, which will be available on the doctors' prescription, announced Mr. V. b. Buch, president of the company.

It contains calcium and other ingredients necessary for the healthy growth of children. For this purpose, it has tied up with Vokhardt, a pharmaceutical company.

It has recommenced production after remaining in a shutdown position for the last few months due to fire mishap that took place on April 18, last.

The dealers and distributors spread over the states of Madhya Pradesh, Rajasthan and Gujarat came forward for financial assistance to the company for recommencing the production as its 15 different brands of biscuits have almost captured the market there, Mr. Buch said.

HORIZONTAL PILLOW PACK



Fastest Indian Machine (30 - 130 packs p.m.)

Maximum Product size : ● 300 mm width
● 120 mm height ● 400 mm length

Products:

- Biscuits, Buns, Rolls, Breadsticks, Rusk etc.
- Cakes, Chocolates, Mithai, Chikki, etc.
- Pasta - noodles, macaroni. Frozen desserts etc.
- Any product of regular shape.

PRODUCTION ENGINEERING CONSULTANTS

206 Aakaar, Kalyan Complex, Yari Road,
Versova, Bombay 400 061
Tel : 6290161, 6271021

At present, it has been manufacturing 3,000 tonnes of biscuits per annum and it is planning to expand it by 750 tonnes more, Mr. Buch stated. Through some agency, the company's biscuits were sold in South Africa and received good response there, he added.

Mr. Buch said there is heavy demand from the markets for the Windsor biscuits and they have been trying to meet this through increased production.

PURE DRINKS

Pure Drinks Limited is planning to augment its product line by expanding into other juices and beverages according to the managing director of the company, Mr. Ajit Singh.

He said the company was thinking of manufacturing drinks like gingerale, barley water etc.

Despite the entry of both Pepsi and Coke in the northern Indian market, Pure Drinks has managed an increase of 25 per cent in its sales in Punjab and 10 per cent in Delhi in 1993-94. The company has reported sales of around six million cases in 1993-94, out of which sales in Delhi constituted four million cases. Mr. Singh attributed this increase in sales to the launch of Coke and he felt that the sales would increase in future also because the volume of consumption of soft drinks has gone up.

He claimed that the one litre bottle of Campa Cola is enjoying a market share of around 65 per cent. Mr. Singh conceded that he was worried that Campa Cola would be wiped out due to arrival of Coke in India but this did not happen because the market had expanded.

He said that their company has gained out of the Cola war. Before the launch of Coke, Thums Up had a market share of 60 per cent, which had declined to 30 per cent after the launch. However, Mr. Singh claimed that those who gained were Pepsi and Campa Cola, and that Coke had not totally taken over the 30 per cent share that Thums Up had given up.

Talking about the internal disturbances in the family, Mr. Singh said, "The disturbances would soon be sorted out and they are not going to affect our beverage business." He said that the company had taken a loan of Rs. 2.5 crore at the interest rate of 27 per cent to re-start the Bombay bottling plant which has been closed for a long time.

KRONES GROUP

The Krones group, the DM 1,500 million packaging and brewing process technology major, is targeting a four-fold increase in its Indian operations in the coming year.

Steinecker, the group's brew house construction, beer filtration and control systems company, has been commissioned to set up the process technology for the Rs. 50 crore Ravi Tikkoo and Holsten joint venture beer operation. Holsten is one of the top German beverage manufacturers with an output of 14 million hl in 1993.

According to Virendra Khanna of Moulders and Crafters, Krones's official representative in India, this project is among the major brewing projects Steinecker will be involved in. Also on the anvil for Steinecker is the Himneel Brewery project for Lowenbrau beer.

The group has worked up orders for up to DM 5-6 million in the past nine months, according to Mr. Khanna. The rapid capacity expansion in the Indian brewing industry, coupled with the grant of over 95 fresh beer licences in 1992, has come as a major shot in the arm for the German conglomerate in India.

Says Mr. Khanna, "The spurt in the brewing business resulted in our licencing tie-up with the Pune-based Alfa Laval." The Indian company is now allowed to set up the Steinecker brewhouse in India but the vital components and the software have to come from the parent company in Germany.

The German company also has a licencing arrangement with the Coimbatore-based Elgi Equipments to supply bottle washing machinery in India. The March 1994 acquisition by Krones AG of a 95 per cent shareholding in Steinecker in Germany allows the group to be a single source for turnkey brewery construction from brewhouse to the palletizer.

Mr. Khanna said the reduction in or low rate of oxidation of the beer in the filtration to bottling stage in the Steinecker brewhouse is the major quality-input provided by the German technology. "The real life of the beer and the taste are influenced by this,"

Krones, which at present has manufacturing operations in the US, Canada and Brazil, in addition to Germany, will set up shop in China. However, Mr. Khanna said, no plans exist for manufacturing in the Indian market, particularly in view of the current licencing arrangement.

INDIAN YEAST / BURNS PHILP

Indian Yeast Co. Ltd., a subsidiary of Shaw Wallace & Co. Ltd., is entering into a joint venture agreement with Burns Philp of Australia, the world's leading yeast manufacturing company.

According to an official release, Indian Yeast will be issuing new shares whereby Burns Philp will have 49 per cent holding in the company. The remaining 51 per cent will

be held by Shaw Wallace. The proposal, however, is subject to the approval of the Reserve Bank of India.

Burns Philp has 30 yeast plants in 17 countries and is also a major processor and international marketer of herbs and spices. Indian Yeast is already the leader with 52 per cent share of the domestic yeast market. Therefore, the joint venture is expected to provide Indian Yeast with the technological and manufacturing edge to make deeper forays in the market. It will also help its expansion and upgradation plans.

Indian Yeast was established in 1960 and currently has two plants at Bhadrakali near Calcutta and Uran near Bombay. It has a strong marketing network all over the country.

The company's product range comprises of compressed and dry bakers' yeast, yeast extracts and cake gel. Compressed yeast is mainly used for bread manufacturing and distillation. Dried yeast is also used for the same purpose but with an additional advantage of longer shelf life, enabling it to be sent to distant manufacturing centers. Yeast extract is used in the pharmaceuticals and petrochemicals industries, while cake gel is used as a pan releasing agent and bread improver.

The population of the country and the growing pharmaceuticals and petrochemicals industries in the country provide the ideal backdrop for a spurt in demand for yeast. The Australian company will be bringing with it the latest technology and combining it with Indian Yeast's marketing strengths to cater to the growing demand.

KHODAY GROUP

The Rs. 350 crore Khoday group is planning to diversify into areas such as tissue culture and food flavours.

The group has already begun scouting around for technical collaboration and the group President, Mr. P. R. Anantha Murthy, just returned after holding negotiations with a couple of leading international companies in the UK. Though the group has several companies under its fold carrying out different types of business, it still continues to have its substantial turnover from distilleries and breweries sector.

The group also made a bid for complicated ventures like Vijayanagar steel plant, polyester filament yarn project and phosphoric acid plant. It already has its presence in distilleries and breweries, engineering, real estate, pharmaceuticals, manufacture of typewriter ribbons and carbon papers, sugar, automatic glass factory, travel agency and stationary to name a few.

KIL is engaged in the manufacture of

Indian made foreign liquor (IMFL) in sugar, engineering and distilling. It is the only listed company of the group on the Bangalore and Bombay stock exchanges. The group has 20 distilleries and 12 bottling units under its control in different parts of the country.

Since 1986, the sales turnover of KIL shot up to Rs. 67 crore from Rs. 15.05 crore, despite ever increasing competition and costs. Profit before tax stands at Rs. 6.50 crore as against Rs. 4.32 crore for the corresponding period last year.

The net profit of KIL has increased almost by three-fold from Rs. 1.31 crore in 1992-93 to Rs. 3.80 crore in 1993-94. The group Vice Chairman and Managing Director, Mr. L. Sri Hari Khoday, said recently, "We have just completed a project to double our sugar capacity from 1250 TPD to 2500 TPD. Our Sugar factory has been decommissioned throughout last year because of its expansion programme. There was, therefore, no question of any molasses supply from our sugar factory for our internal consumption." But how did Khodays make huge profit if the molasses are brought from open market at a high rate, is a question for which the Khodays do not offer any answer.

The Khodays enjoy over 70 per cent of the defense market but this is coming down as the competitors are willing to cut down their prices. While on the other hand defence sector is not willing to raise its prices.

"Khodays can boast of having its presence in popular, premium and super premium segments owning popular brands like Peter Scot Whisky, XXX and Hercules Rum and Sovereign Brandy which has to vie with Royal Challenge, Antiquity, Black Royal Velvet and Single Malt. In the super premium segment the competition is intense with higher price and better quality, even the Khodays No. 1 Whisky did not pick up", says Mr. U. B. Bhat a Management Consultant.

To a question why their expensive brands are not doing well and why they are not increasing their activities in liquor, the Vice Chairman said "even today, the liquor industry is not free from many restrictions. Each state government prescribes its own rules and levies for movement of liquors. Heavy export fee and import fee for movement across the state borders are levied apart from considerable excise duties and other imports. The cascading effects of all these are very high consumer prices. therefore, even if economic considerations indicate that we should substantially increase our operations, we cannot achieve this easily."

Khodays are having discussions with foreign liquor companies to ward off competition in the domestic market. They are diversifying their activities for setting up a 100 per

cent export oriented tissue culture unit with Dutch collaboration and is in food flavours with British collaboration for manufacture of international quality flavours for biscuit, confectionery, soft drinks, ice creams, pharmaceuticals and liquor industry.

Asked why they are branching into several areas where the profitability is very low, Mr. Hari Khoday said "It will be appreciated that any point of time there will be a number of ideas under exploration and new projects under consideration. Profitability alone cannot be a deciding factor in enlarging our field of operation."

KEDIA GROUP

The German beer giant Dab Brau-Consult-GMBH, with group turnover of \$ 4.3 billion (Rs. 13,000 crore), is coming to India with its international brands through a joint venture with the Kedia group, the largest manufacturers potable alcohol in the country.

The tie-up between Kedia Distilleries Limited and the German group proposes to set up five brewery units in India with a total capacity of nine million litres.

The total investment in the brewery projects is expected to be in the region of Rs. 200 crore. As per the technical and marketing agreement between the two companies, the Kedias will be allowed to produce as well as market beer under Dab Brau-Consult's brand names which may include Dab, Binding, Hansa and several others.

One unit will be set up in Madhya Pradesh, and two each in the western and southern regions. The brewery in Kerala will be a part of a modern distillery complex that the company is working on. The project will be funded through internal accruals, institutional borrowing and from the investing public through an equity issue slated for the month of October.

"The project will be operational by March 1995 and we expect a turnover of Rs. 250-300 crore in the first year of operation and by that time the group turnover will be in the range of Rs. 850 crore" said Mr. K. P. Kedia, Chairman of the group. While this may be quite impressive, it remains to be seen if the company will be able to counter the marketing efforts of the UB Group which commands a 40 per cent market share of beer in India.

The company will also introduce its own brands. The company is looking into the possibility of using its existing liquor brand names for beer. The rationale behind this is to cash in on the existing brand image and avoid the Herculean exercise of building a market for a new brand.

While the Indian brands will be marketed in bottles, the German brands will be marketed in cans. The names of Indian brands are yet to be decided.

On the anvil is also a new marketing company in addition to the two existing companies under the banner of Castle Douglas Ltd. and Great Glen Distilleries Ltd. The new company will be a division of Kedia Distilleries Ltd. which recently went public for an equity issue. With the aim of capturing a larger marketshare, the company has plans to increase its advertising budget five times to Rs. 10 crore in two years time. It is, however, not very clear why the company needs to set up a new marketing company, when two other marketing companies already exist in the group.

Kedia's latest endeavour is also to set up the largest distillery project in Asia. The management claims that this project will be unique as it will be a "zero pollution distillery." The project will be set up in Rajasthan and will produce 2.5 lakh litres per day of potable alcohol from grain.

The project which is likely to cost Rs. 140 crore will be implemented by Castle Douglas Industries Limited, which is sought to be projected as the flagship company of the group.

The new distillery project has been subdivided into six activities - Grain based manufacture of alcohol, production of IMFL, production of malt spirit and maturation, bottling of scotch whiskies, manufacture of enzymes for captive usage and effluent treatment (DGDS) zero pollution systems.

The grain based distillery will produce liquor from starch material like broken rice and spoiled grains like jowar, bajra and corn to meet the demands of both IMFL and country liquor manufacturers in and outside Rajasthan. A boon in disguise for the IMFL industry which is already plagued by the uncertain supply of molasses.

With opening up of the economy and the liberalisation policies of the government, the Kedia group plans to bottle reputed Scotch whiskies in Rajasthan in a joint venture with Douglas Liang and Company Limited. For this, Scotch whisky blends will be imported in bulk from their collaborators. The necessary processing for these blends would be carried out till the finishing stages will be bottled under the brand names which will be decided with the collaborators at a later stage.

The company is also setting up a 100 per cent EoU to market distillery dried grain as poultry and cattle feed, earning valuable foreign exchange. The other companies in the group are Great Glen Distilleries & Wineries Ltd., Kedia Distilleries Limited, Kedia Liquor Ltd. and KCT Drinks Ltd. Douglas

Liang Limited will act as the nodal body for import, bottling and marketing of scotch whisky in India in technical collaboration with Douglas Liang & Co. Ltd. Glasgow, Scotland.

The Kedia Group, established in 1969, has brands like India No. 1, Darlington Ritz and Palm Beach for whisky, highball and Iceberg for gin, Safari and Robinhood for rums, Honeydrop and High Queen and Vodkas like High Ball and the Cheers series.

UNITED BREWERIES

The United Breweries (UB) group's tie-up with the UK-based United Distillers, for the setting up of facilities to blend and bottle whiskey at Nashik in Maharashtra, is finally taking shape. The products from this tie-up, which would be launched in early October, will be the popular brands 'Black Dog' and 'Black and White', industry sources state. Both the partners will have an equal stake in the joint venture.

Many foreign hard liquor manufacturers are scouting around for Indian partners, in a bid to tap the growing liquor market in the country.

According to high-level sources in the industry, the makers of Chivas Regal were looking for Indian partners with multi-locational bases in the country.

With foreign manufacturers showing interest in the hard liquor market, tie-ups in the beer market is likely to get a boost in the future. Leading foreign beer brand manufacturers like Germany-based Henninger, US based Budweiser, Miller are negotiating possible joint ventures in the country.

The foreign partners, according to Mr. Percy J. Driver, Area Sales Manager, Associated Breweries and Distilleries (ABD) were looking for Indian manufacturers with a more stronger marketing network.

In a bid to expand their area of network, the ABD group has also tied up with Blossom Breweries. According to the agreement, ABD will market 90 per cent of the production in brewery. The technological know-how would be supplied by ABD. This tie-up would help ABD to transport beer from the Daman unit to Gujarat, Delhi, MP and Rajasthan, further increasing their field of operations.

In terms of exports, presently, both the UB group and ABD group are exporting about 100,000 cases a month. The UB group exports its products to Japan, the UK and the Middle East, while the ABD group exports its beer to Japan, the UK, and the US.

STARCHIK

Starchik Specialities is promoted by the

directors of the well known poultry group, Singh Poultry Ltd., Mr. Harbans Singh, Mr. Amariyot Singh and Associates. SSI is launching its project for processing chicken meat and manufacturing animal feed.

The project will have an installed capacity to process 1500 birds per hour and will produce 4050 MT of dressed/frozen chicken per annum at full capacity. It will also manufacture 18000 tonnes of animal feed per annum. Sixty per cent of the produce will therefore find ready market in places including Hyderabad, Secunderabad, Warangal, Nizamabad and Karimnagar. The company has already conducted these activities on a small scale and test marketed its products. In the 10 months of test marketing it has recorded a income of Rs. 1 crore and a profit of Rs. 3 lakhs.

The processing plant will be located at Kesoram Village, about 38 kms from Hyderabad. SSL proposes to utilise the existing facilities of feed plants located at Hyderabad, Rajamundry and Vijayawada for manufacturing animal feed on franchise basis.

The company has already acquired land for setting up its processing plant. The land development is completed and civil construction will be completed by June, 1994.

Orders for major plant and machinery have already been placed. The necessary clearance from Pollution Control and Electricity Board have been obtained. The company also proposes to install cold storage facility of 400 MT to take advantage of lower procurement cost of broilers during the slack season. It is also acquiring water chilling unit.

SSL is proposing to sell its products both in the domestic and international markets. The processed and dressed chicken will be sold under the brand name 'Starchik'. The animal feed will be marketed under the brand name 'Starfeed'. While the domestic sales will be targeted at Andhra Pradesh, 40 per cent of the production will be exported to the Middle East and Far East countries. The company has already entered into a MOU with Alburq Exports, Dubai for export of processed meat. Alburq Exports has already agreed to buy 40 per cent of the company's

total production. The company's total production of animal feed will cater to just 2.6% of the total demand. However, the company would prefer to sell in the domestic market since margins are lower from exports.

The company in addition to processing chicken and manufacturing animal feed will also manufacture meal from the wastage arising out of processing. The company has projected a 70 per cent capacity utilisation of processing division and 80 per cent capacity utilisation of feed division resulting into a sales of Rs. 19.2 crores with PBT of Rs. 3.82 crores and PAT of Rs. 2.79 crores. The company is expecting a EPS of Rs. 5.21 on a equity base of Rs. 5.36 crores in 1994-95.

AGRO-CORN PRODUCTS

The Karnataka government has proposed to establish one more unit of Agro-Corn Products Ltd. at Dharwad, said Mr. H. M. Revanna, the minister of state for agriculture, recently.

While laying the foundation stone for the construction of a godown for Karnataka State Agro-Corn Products Ltd. (KACPL), the minister said that the company's existing unit had a production capacity of 18,000 tonnes, whereas the requirement of the state was 25,000 tonnes. Hence, it was decided to set up one more unit at Mundargi taluka of Dharwad District.

The minister said that many public sector companies were running at a loss, but KACPL was one of the few companies making profits.

Mr. K. H. Kuradigi, the president of KACPL and MLA of the state assembly, stated that the company had computerised the production process. "If the government establishes one unit of this kind in each district of the state, the distribution costs can be reduced," he added.

KACPL came into existence in 1973 to protect the interests of farmers, especially the maize cultivators who felt they were not getting the right price for their produce.

KACPL manufactures maize products, rich protein food for children and animal and poultry feed. The company has been making profits for the last one decade.

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INDIAN EXPORT HIGHLIGHTS

MARINE PRODUCTS

India has achieved a record fish production of 45.72 lakh tonnes during 1993-94. There has been a quantum increase in the production of fish during the first three years of the Eighth Plan, says an official release. At the end of the Seventh Plan, the total fish production in the country was 38.36 lakh tonnes.

A significant increase has also been registered in marine exports. The export of marine products during 1992-93 was valued at Rs. 1767.43 crore. This is expected to touch Rs. 2105 crore during 1993-94.

Though shrimp accounted for 45% of quantity and 74% of value of export in recent years, there has been diversification and the country is exporting frozen squid, cuttle fish etc. in large quantities. The total outlay for the fisheries sector is Rs. 95 crore for 1994-95.

SESAME SEEDS

Exports of sesame seeds, which had taken a beating during last fiscal year, are on the path of recovery. Shipments for the first three months of the year 1994-95 have jumped to 5,000 tonnes as against 16,845 tonnes for the

whole of 1993-94. These shipments (in first three months of the current year) are valued at around Rs. 11 crore compared to Rs. 33 crore during last year. Exports of this commodity for the month of April in 1994-95 alone were 1,191 tonnes.

The world export market for sesame seed is estimated to be about 5 lakh tonnes. Major importers include Japan, USA, Canada, Europe and countries of the Persian Gulf & Mediterranean region like Turkey, Jordan, Israel, Syria, Cyprus. The countries in the Mediterranean region accounted for a huge 73.6 per cent of India's total sesame seed exports in 1992-93.

India accounts for one-third of the world's total sesame seed production and cultivates an impressive variety and grades to suit the end users. The production of sesame in the country for the last few years has averaged around 7 lakh tonnes. Though it occupies 12 per cent of the total area under cultivation of oilseeds, it contributes a mere 4 per cent of the total oilseed production. Considered to be a premium oilseed, sesame is harvested during summer and winter. Although grown all over the country, the best quality of export grade sesame, white sesame, is found in the western states of the country. Demand for

white sesame emanates from confectionery and food units. On the other hand, brown and black sesame is traditionally used for extracting oil.

SPICES

Export of spices from India during 1993-94 has reached an all time record both in terms of quantity and value. The exports have shown spectacular growth of 38% in quantity and 32% in value (in rupee terms) compared to last year. In Dollar terms, the exports have shown an increase of 22 per cent. The total exports during the year is estimated at 175,532 tonnes valued at Rs. 540.12 crores (172.20 million US\$) as against 126,820 tonnes valued at Rs. 409.48 crores (141.34 million US\$) of 1992-93. Exports have crossed the target of Rs. 500 crores fixed for the year. Exports of large cardamom and curry powder achieved record performance both in terms of quantity and value. The performance of Pepper, Chillies, Ginger and Celery in quantity terms; Turmeric, Fenugreek and Spice Oils and Oleoresins in value terms have surpassed the previous highest.

The export of value added spices from India has gone up remarkably to 23,736 tonnes valued at Rs. 151.04 crores.

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Jazira & South, P. O. Box 843, Amman 11941. Tel: 9626-829260. Fax: 9626-829261. Wish to buy Chemicals, Sugar, Rice, Meat and Food-stuffs.

KUWAIT

Dar Al-Aman United Co., P. O. Box 41049, Jelceeb A-Shyokh 85851, Kuwait. Fax: 965-4336137. Importers of foodstuffs such as milk powder and grains, fruits, vegetables and fish, electric household appliances.

PAKISTAN

Venus Corporation, 11, Rehman Chambers, Akhund A. Rehman Street, Jodia Bazar, Karachi-2, Tel: (92-21) 220427 / 221758. Cable: VENUSTEA. Fax: (92-21) 2434488.

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Gulf Technical & Trading Co., P. O. Box 1052, Doha. Tel: 0974-414088, Fax: 0974-414537, Telex: 4692 QATARI DH. Wish to buy medical equipment and foodstuffs.

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Ahmad. A. Abed Trading Est., P. O. Box 9440, Riyadh 11413. Tel: 966-1-4773419, Fax: 966-1-4770741, Telex: 403765 WAHAB SJ. Importers of bakery, pastry and hotel ingredients.

Al-Essa Trading & Import Office, P. O. Box 1255, Al Khobar 31952, Fax: 8943809. Wish to contact manufacturers of foodstuffs such as sweets, snacks, candies and chewing gums.

SINGAPORE

S. Rajasegaran, Blk. 386, No. 09-1715, Yishun Ring Road, Singapore 2776. Importers of Sugar.

SOUTH AFRICA

World Trade Unlimited, P. O. Box 19733, Tecoma, 5214, South Africa. Importers of Processed Foods.

TAIWAN

M & J Enterprises Co. Ltd., No. 406-5, Min Chuan Rd., Taichung, Taiwan. Tel: (886)-4 2038112, Tlx: 56160-MJLL, Fax: 886-4-2037496. Importers of Ice Box (Fridge), (50-150 Litres) AC 110V/60 HZ.

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TRADE FAIRS & EXHIBITIONS

FI CHINA

Venue : Shanghai, China
Date : 14-19 October 1994.

China is the world's biggest emerging market. Its double-digit economic growth in a generally depressed world draws investments to the country like a powerful magnet. Foreign investments reportedly went up by 33.2% in the first nine months of 1992 over the same period in the previous year.

Food Ingredients China, or FI CHINA, is organised to help fill the technological gap - to present new technologies and solutions offered by the international as well as local food ingredients manufacturers to food processors in China in their pursuit of new, convenient and more efficient foods.

FI CHINA is the latest addition in the series of FI exhibitions and conferences in Europe and Asia.

For details, write to : Expoconsult Pte. Ltd., 100 Beach Road, # 27-08 Shaw Towers, Singapore - 0718, Tel: ++65 29 99273, Fax: 65 29 99782.

SIAL '94

Venue : Paris-Nord Exhibition Centre
Date : 23-27 October 1994

The International Food Exhibition, which brings together food products from all over the world, is a trade-only exhibition for specialists, decision makers and representatives from all over the food industry.

Exhibitor total : 3,995 including 1,710 French and 2,285 international exhibitors from 72 countries from the following product categories : PAI (Intermediate Food Products) - dairy products and eggs - fresh meat and offal - fresh poultry and game - fish and shellfish - fresh fruit and vegetables, horticulture - confectionery, biscuits and quality breads - salt-cured and cooked meats - catering products - canned foods - pet foods - frozen foods, ice creams and chilled desserts - dietetic and baby foods - grocery.

SIAL provides exhibitors with an opportunity for meeting contacts whose professional calibre is guaranteed by the exhibition's rigorous controls, especially its visitor monitoring system based on bar code identity

cards, a feature unique to SIAL. In addition to this controlled admission system, invitations are sent out exclusively to the trade.

SIAL is also a showcase for innovative ideas in the food industry and, since the very first, has been deeply committed to highlighting New Products.

In addition, SIAL 1994 will focus on two important sectors of the food economy: catering, both commercial and institutional, and food ingredients intended for use in industrial food production : sweeteners, colourings, basic products for the preparation of frozen foods, etc. At the forthcoming session of SIAL, the Catering and Food Ingredients sectors will each have their own specialised reception centre and interactive database accessed via terminals dotted around the exhibition.

For details, write to : Society SIAL SA, 39, Rue De La Bienfaisance 75008, Paris-France Tel: (33) 1 42 89 46 87 Telex: 650614 Fax: (33) 1 42 56 72 33, (33) 1 42 89 46 94.

BRAU 94 NURNBERG

Venue : Nurnberg, Germany
Date : 10-12 November 94

From the 10th to 12th November 1994, Nuremberg's Messezentrum (Exhibition Centre) will be the international meeting place for the brewing and drinks industry and its suppliers. BRAU 94 Nuremberg is a splendid opportunity, at the end of the "drinking year", for drinks manufacturers to take stock, to prepare for new investments and to discuss the purchase of raw materials from all over the world. About 1000 exhibitors from 22 countries will show their products at BRAU 94 Nuremberg, 56 of whom (6%) will feature raw materials.

For more details, contact : Nurnberg Messe GmbH, Messezentrum, D-90471 Nurnberg. Tel: 09 11/86060, Fax: 09 11/8606228, Tlx: 623613 messe d.

SIMEI

Venue : Milan, Italy
Date : 19 - 23 November 1994.

The 6th international exhibition of

Oenological and Drinks Bottling Machinery (SIMEI) will be held from 19 to 23 November at Milan, Italy. It is the largest exhibition in the world simultaneously presenting all of the different types of machinery and equipment for oenology and the bottling of drinks and other liquids.

The exhibition covers the most technologically advanced and economically advantageous versions of small, medium-size and large bottling plants, machinery of all kinds for handling grapes and treating wine, material for the production and packaging of bottled liquids, equipment for internal company use, containers of every type and size, technological coadjuvants and so on.

This exhibition will bring together about 600 companies from 16 countries.

For further details, contact : SEMEI's office at via S. Vittoreale Teatro 3, 20123 Milan, Italy. Tel. : 39-2-801595 Fax : 39-2-866226.

25TH INTERNATIONAL SWEETS & BISCUITS FAIR

Venue : Cologne, Germany
Date : 29th January - 2nd February 1995

On its 25th anniversary the International Sweets and Biscuits Fair will demonstrate its uniqueness as a trade fair in the sweets sector more clearly than ever. As the world's largest and most important specialist fair of its kind, the event will provide a comprehensive overview of the international ranges to exhibitors and trade visitors from 29th January to 2nd February 1995.

Of the more than 1,200 exhibitors from over 50 countries, more than 70% come from abroad. The participation of international market leaders underlines the significance of the number one fair in the business. From world brands to local specialities, Cologne will present the full range of products in the chocolate, sugar confectionery, biscuits and pastries, savoury snacks, ice cream and raw pastes segments, all in shop-ready packs.

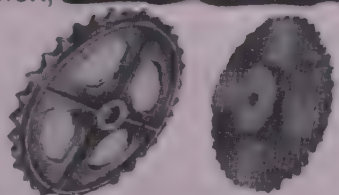
For more details, contact : Messe-und Ausstellungs-Ges. m.b.H., Köln, Messeplatz 1, D-50679 Köln, Postfach 210760, D-50532 Köln. Tel : (0221) 821-0, Tlx : 8873426 mua d, Fax: (0221) 8212574, Gram: Inter mess Köln.



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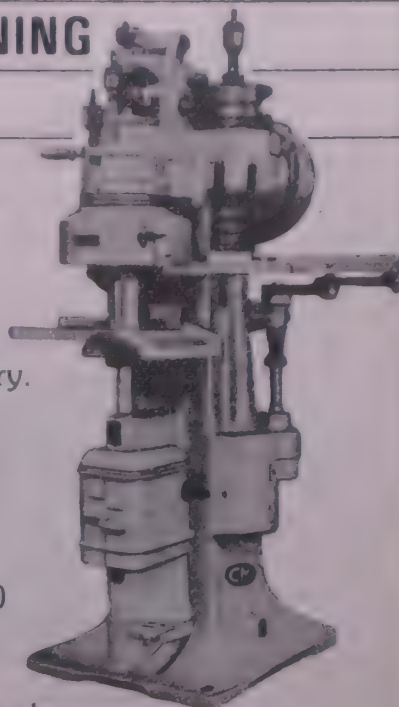
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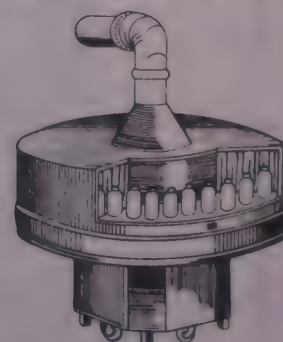
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BOOK REVIEWS

Concentrated and Dried Dairy Products. M. Caric, University of Novi Sad, Bulgaria. 1994. XIII, 249 pages with 98 figures and 34 tables. Hardcover. DM 179.00.

Concentrated and Dried Dairy Products presents a comprehensive overview/review of the very latest techniques used in manufacture of concentrated and dried dairy products, covering all practical and theoretical principles as well as the relationship between technology and quality.

Contents : Introduction : The manufacture of concentrated and dried dairy products / Unsweetened condensed milk / Other condensed milk products / Milk powder : General production / Milk powder : Production of specific products / Infant formulas / Miscellaneous dry products / Whey / Casein / Lactose.

Beverages. A. Varnam, Southern Biological, United Kingdom, and J. Sutherland, Institute of Food Research,

United Kingdom. Pages 464 (Softbound) Price : \$ 72 (Via Airmail)

Beverages, provides thorough and integrated coverage in a user-friendly way. It is an invaluable learning and teaching aid and is also of great use to the food industry and regulatory personnel.

Contents : Introduction, Spring Water and other Natural Waters, Fruit Juice and Nectars, Squashes, Cordials and Carbonates, Tea, Coffee, Cocoa and Drinking Chocolate. Also included : Alcoholic Beverages as well as Nutritive, Fortified and Special Purpose Beverages. 70 line Illustrations.

Integrated Design of a Fermentation Plant. The Production of Baker's Yeast. B. Kristiansen, University of Strathclyde, Glasgow, GB 1993. XIV, 87 pages with 12 figures and 6 tables. Hardcover. DM 98.00.

The successful design and operation of a fermentation plant embraces many complex facets. This book provides readers with a clear understanding of them. Succinct and

still comprehensive, the book treats such vital topics as Production medium; Microbial growth; Preparatory steps; Cultivation equipment; Downstream processing.

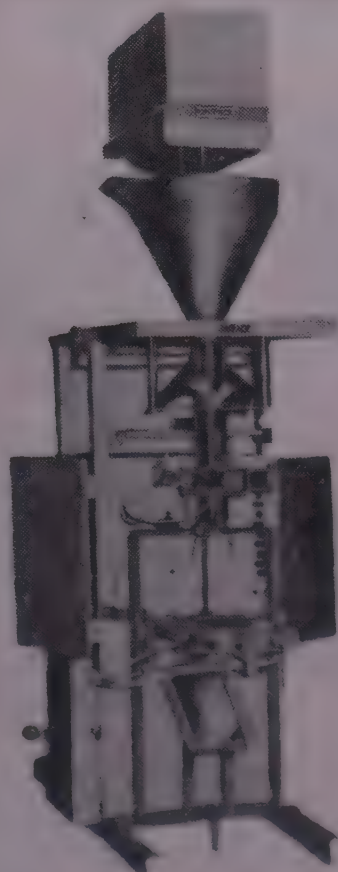
Moreover, a simulation program on diskette is included, complete with details on how to use it effectively. It gives complete freedom in evaluating the impact of design construction and process operation variables on the plant. The diskette can be run on any DOS personal computer. The volume was edited on behalf of the Working Party on 'Bioreactor Performance' of the European Federation of Biotechnology. It reflects the unparalleled expertise and experience found in this multinational working group.

Contents : 1. Design Methodology : Introduction / The Production Plant / The Biology of Baker's Yeast / 2. Biological Aspects: Production of Baker's Yeast / Production Medium / Microbial Growth / Product Quality / 3. A Model Description : Introduction / Model Strategy / Kinetics / Completing the Model / 4. Plant Design and Operation : Process Layout / Preparatory Steps / Cultivation Equipment / Downstream Processing / A First Design Effort / 5. The Simulation programme: Introduction / Load Setup / Edit / Run / Options / References / Notation.

Production and Packaging of Non-Carbonated Fruit Juices. 2nd Edition. P. R. Ashurst, Dr. P. R. Ashurst & Assoc., Consulting Chemists, UK. Pages : 432 (Hardbound) Price : \$ 174 (Via Airmail).

This book reviews the fruit juice and fruit beverage industry, including nectars, from grower to distributor, including fruit handling and processing, chemistry and characterization, analysis of quality control, nutritional value and packaging.

Contents : Processing of citrus juices; Chemistry and technology of citrus juices and by-products; Authentication of fruit juices. Tropical fruit juices; Growing soft fruit for juices and beverages. Equipment for extraction of soft and pome fruit juices; Apple juice; Grape juice processing; Juice enhancement by ion exchange and absorbent technologies; the formulation of sports drinks; Nutritional value and safety of processed fruit juices; Packaging systems for fruit juices and non-carbonated beverages; Production consumption and flavor problems; Water and effluent treatment for juice and beverage plants.



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They also represent Potato Manufacturing Science UK for potato based products.

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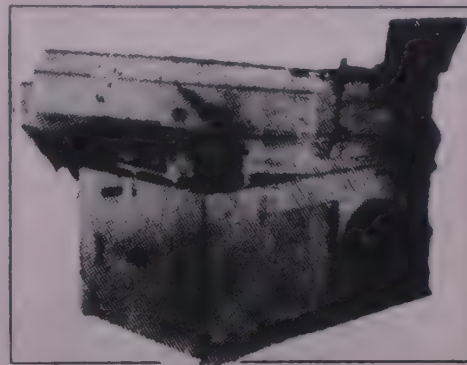
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AGRITECH MACHINERY

Forsberg machinery which is now manufactured by Forsberg Agritech (India) Pvt. Ltd., the sole collaborators of Forsberg Inc., U.S.A., supplies all your separation needs. Grains, oilseed, pulses, spices, etc. can be processed with the machinery, preserving flavour, aroma and colour, while removing impurities.

The range of specialized machinery includes Gravity Separators,

(See pic. below), Screen Aire Separators, Vacuum Destoners, Impact Hullers, etc. used for black pepper, coriander, cardamom, cumin, celery, fennel, dil, etc. as well as soyabean, groundnuts, sunflower, rape seed, mustard, sesame etc.



Gravity Separator

For your requirement, contact:

Marketing & Products Services,
315 Race Course Towers,
Baroda 390015.
Tel : 320597 Fax : (0265) 338150
or
Forsberg Agritech (India) Pvt. Ltd.
123 GIDC Estate Makarpura,
Baroda - 390010
Tel : (F) 445752 (Off) 320597
Fax : 338150

ULTRAVIOLET SYSTEMS

Hitech Ultraviolet systems eliminate oxides and other contaminants in ultra pure water by using only Teflon and PVC as parts which contact water. The excellent ultra violet transmission characteristics of Teflon contains a higher ultra violet field which results in a better kill of micro-organisms.

A special water flow pattern through the Teflon tube assures turbulence and full exposures to the ultraviolet rays. High turbulence and non wetting characteristics of Teflon eliminate any build-up of contaminants that could block ultra violet rays. Hence no wiper of chemical additives systems are necessary. Separation of fluid circuitry from electrical circuitry allows the lamps to operate continuously even without water. This also allows the ultra violet light to operate at their optimum operating temperatures, so they can produce optimum ultra violet light.

Hitech Ultraviolet also manufacture TOC (Total Organic Carbon) reduction sterilizers which oxides organics into carbon di-oxide gas.

Application : Aquaculture, Beverage Industries, Breweries, Dairies, Water Bottlers, R. O. Systems, Wash Water for Food products such as vegetable, fruit, fish etc. Toxic Chemical Distribution, etc. Pharmaceuticals and Cosmetics Industries, Hospitals, Laboratories, etc.

Hitech Ultraviolet manufactures sterilisers in various capacities depending on the flow rate required by each application and a maximum capacity of 12 lac. L.P.H.

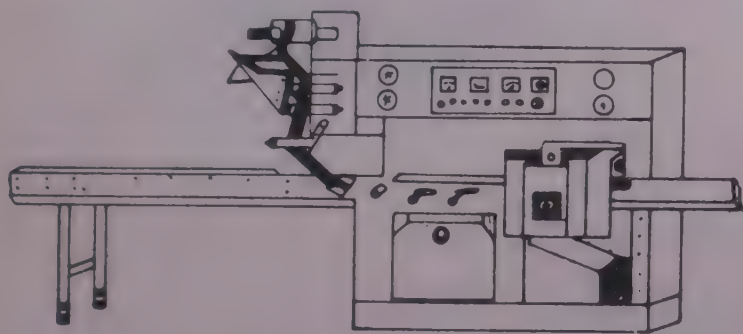
For more details, write to :

Hitech Ultraviolet,
P. B. 8356
C/14 Grace Plaza, S. V. Road,
Jogeshwari (West),
Bombay - 400 102.
Tel : 6286845 / 6282517 / 6244574 / 6244576
Fax : 6206702

PACKING MACHINES

The Company is leading manufacturing of the following machines for the past 7 years

* Horizontal Pillow Pack Wrapping Machine for packing Biscuits, Ice Candy, Cream Wafers, Soaps, Pan Masala, Spices, Shampoo, Auto spare parts, Papad or any flat product which can move on conveyer belt without falling.



Pillow Pack Packing Machine

* Cream Wafer Plant. Beside ovens, the company manufactures all the necessary equipment viz-Creamer, Cutter Mixer and Packing machine, to manufacture Cream Wafer.

* The Company also manufactures VFFS pouch packing machines for Pan Masala, Spices, Shampoo etc. In the new range of products, new Indo International have recently started manufacturing Candy Packing Machine, Vertical Form Fill and Seal Machine, semi-automatic filling and conveyor type Band Sealing Machine with speed of 10 mtrs per minute.

The list of customers include Cadbury India Ltd, Albert David P. Ltd., Kwality Ice Cream (P) Ltd., S. K. Industrial (Mahak Pan Masala) Katana Food, Nutrine Confectionery, Bakeman, K. R. Biscuits, Amba Products, Crown Biscuits etc.

New Indo International also manufactures On-Edge Pillow Pack Machines for naked Biscuits packing.

For more details, contact :

New Indo International,
135-A, Begumpur, Malviya Nagar,
New Delhi - 110017.
Phone : 6445315, 6453289 Resi. : 6470641

GRAVITY SEPARATORS / DESTONERS

M/s John Fowler (India) Limited, a four decade old Engineering company diversified into manufacture of Agro products processing equipments. The hi-cap Gravity Separators and Destoners are manufactured

under technical collaboration with world leader M/s Oliver Mfg. Co, Inc. USA to stringent quality and specifications.

To cater to different capacity requirements, Gravity Separator Models 240, 160 and 30 Lab Models are offered. These separators having large rectangular deck area, ensure better stratification of product as heavies, medium and lights. These are pressure-type machines fitted with a series of fans with individuals control which facilitates fine adjustments for better separation.

Destoner come in Models 6048 and 4848 and are again with multiple fan system with adjustable deck inclination making them reliable for all types of agricultural products.

John Fowler also manufacture Seed Treaters to treat seeds with protective solution with proper coating. These come in varying capacities from 1 Tonne to 5 Tonne per hour. All parts coming into contact with seeds or solutions are made of stainless steel to avoid any contamination and corrosion.

The machines need minimum operational skills and are simple to maintain ensuring greater efficiency. They are indispensable for the food and beverage industry.

For more details, contact :

John Fowler (India) Limited,
Sarjapur Road,
Bangalore 560 034
Tel : 5530026 Fax : 91-080-5533228
Tlx : 0845 2545.

INDUSTRIAL HEATING ELEMENTS

Subash Gupta & Co. manufacture all kind of Industrial Heating Elements. These Tubelcor Heating Elements are made out of Copper, Brass, Stainless Steel and Incoloy pipe. They also make Mica & Ceramic Band Heaters in Mild Steel, Brass and Stainless Steel Covers. Besides all types of standard Heaters like Water Immersion Heaters, Lead Heaters, Alkaline Heaters, Air Heaters and Finned Air Heaters as well as special heaters as per customers specifications, they are specialists in Packaging Heaters like Cartridge Heaters and Jacket Heaters. Most of the big manufacturers of packaging machines and packaging machine users are on their customers list. Each and every heating element is subjected to the most of stringent quality control inspection at each stage prior to clearing for despatch.

For further information, write to :

Mr. Subash Gupta
Subash Gupta & Co.
A-45, Nand Gram,
Meerut Road,
Ghaziabad - 201003
Tel : (0575) 8-733866

Factory:
B-115, Jagat Puri,
Mandoli Road, Shahdara,
Delhi - 110093
Tel: (011) 2293795, 2288073 (P.P.)

STICKER LABELLING MACHINE

Maharshi Udyog manufactures Sticker Labelling Machine suitable for any type, any size of container with speed ranging from 60 to 200 containers per min., depending on length of labels. Sticker labels have better adhesion property on plastic, metal and glass container than wet glue labels. Apart from this it is a very neat and clean operation. This machine is suitable for Pharmaceutical, Food, Cosmetics, Oil Industries. Also it is suitable for Marking pen and Pencil Cells. This machine also consists of Imprinter (On-Line Printer) suitable for Batch No., Mfg. year etc. There are three options. Imprinter Electromagnetic, Pneu-

matic & Hot Foil Printer.

For further information, contact :

Maharshi Udyog,
4, Ruchi, 36, Swastik Society,
Navarangpura,
Ahmedabad, India
Fax : 079-425456
Tlx : 0121 6369 GOPI IN.

TEMPERATURE SCANNER/CONTROLLER



The 3-channel temperature scanner/controller from P J. Electronics is a compact unit housed in a standard 96 x 192 mm frame size, panel mounting box with a depth of 150 mm (cutout size 92 x 188mm). It works on 230 V AC, $\pm 10\%$ 50 Hz supply. The unit is vertical mounting type and all displays and control keys are located on the front. It can be programmed for three different set points, in degrees Celsius, for three channels, and control the set temperatures by switching of heaters through external solid state relays. The unit can accept any one type of (prespecified) input feedback as Pt-100 RTD or a thermocouple. The unit can be set for 0-250°C for every channel, least count being 1°C. In Run mode, it will normally display scanned channel numbers and actual temperatures one by one. It can be set to display one selected channel continuously. Any one channel can be put on or off. At power-on, all channels will be On which is assumed to be normal condition. The system will be in Run mode normally. Status of the outputs are shown by LEDs. Method of control of temperatures will be time proportional type, which can achieve close control on temperatures if proper wattages of heaters are selected. Deadband can be programmed separately for each channel. The unit is capable of indicating faults such as faulty sensors, probability of fault in heaters, etc. In case any fault occurs, audio-visual indication is given.

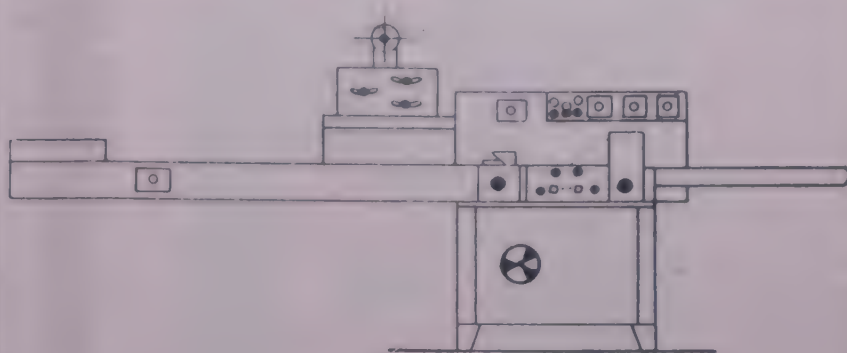
For further information, write to :

P. J. Electronics
Unit No. A/24,
45 Dr. Ambedkar Road,
Pune - 411 001.
Tel : 623710.

HORIZONTAL PILLOW PACK MACHINE

The fastest Indian Horizontal Pillow Pack Machine has been developed based on latest European designs by Production Engineering Consultants who have over 30 years experience in import substitution of Pharmaceutical and Packaging Machines. It seals and packs Bakery and Confectionery products and other products like soaps, pasta, napkins,

kerchief and products of regular shape. It has already been exported.



Horizontal Pillow Pack Machine Model : PEC-100

Description : Continuous motion horizontal packaging machine for (Pillow-Pack) style wrapping of products with film fed from a reel.

Maximum width : 230 mm.; Maximum height : 120 mm with continuous variator regulation; Cut-off Length : 60 mm to 900 mm.; Maximum reel width : 570 mm.

Products to be wrapped : General oven products (biscuits, buns, etc.) Confectionery (Cakes, Chocolates, etc.) and any other product of sufficiently regular shape.

Wrapping materials : Heat-sealable materials such as cellophane, polypropylene and laminates in general. Cold sealing materials.

Operating speed : From 30 to 130 packs/minute, depending on the properties of the product and the wrapping material.

For more details write to :

Production Engineering Consultants
206, Aakaar, 'C', Kalyan Complex,
Vasi Road, Versova,
Bombay - 400 061.
Tel : 627 1021 / 629 0161

BAKERY EQUIPMENT

Baker Enterprises of Delhi are manufacturers and exporters of a complete range of high tech "BREDO" brand Bakery Equipment. They have newly introduced High Speed Mixers, Flour Sifters and Ovens for Hotels and Bakeries.

Baker Enterprises also provide consultancy service and technical knowhow.

For more details, write to:

Baker Enterprises,
23, Bhera Enclave,
Near Peera Garhi,
New Delhi - 110 041.
Tel : 558 6238 / 558 6150
Fact : 547 72171

LUG CAP SEALING MACHINES

Introducing for first time, Twist-off Lug cap sealing machine to give 100% leak proof air tight seal for 53mm & 63mm Lug Caps. Thorough R & D has evolved innovative machines which are successfully packing over one million bottles without maintenance.

Semi Automatic and Automatic machines have capacity of 1200 & 2200 bottles / hr respectively. Innovative design ensures smooth working and eliminate holding of glass bottles while capping operation. Only effortless manual bottles movement is required which eliminates

need of skilled worker. Standard machines are designed to work for any bottle height from 9 cm to 15 cm.

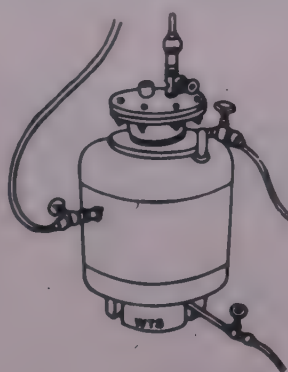
Machines are mainly used by manufacturers and packers of Pickles, Jams, Ketchup, Aryurvedic Medicines, Honey etc. These machines are replacing hand models and running satisfactorily at 30 installations today. Raj Product & Services also offer complete pickle making, filling, washing & packing line.

For more details, write to :

Raj Products & Equipments,
P. O. Box - 8075,
Bombay - 400 056.
Tel : 8192250 / 8192750

WATER TREATMENT PLANT / CHEMICALS

Water Testing Services offer a wide range of water treatment plants and chemicals.



WTS 'DOSER 40L

WTS 'DOSER 40 L' consists of a collapsible rubber bag held by flanges of the pressure vessel. The chemical solution to be dosed is filled in the rubber bag. Water mains are connected on two sides and solution is dosed in line by creating differential pressure.

WTS 'DOSER 40 L' used for coagulation to remove organics and suspended impurities from water by using alum, sodium aluminate or ferrous sulphate, for chlorination by using bleaching powder or hypochloride solution, for dechlorination by using sodium sulphate, for boiler feed conditioning like maintaining pH by addition of alkali and de-oxygenation by sodium sulphate or hydrazine.

WTS 'PSF' are pressure filters used mainly for removal of turbidity and suspended matter from water for industrial and drinking purpose.

WTS 'ACF' are activated carbon filters used for removal of chlorine, colour, organic impurities and small quantity of suspended matters from raw water resulting in long life of ion exchange resins.

'WTS UF' softners are simple to operate small softners designed on 200 PPM hardness working on counter flow regeneration technique, to give fine quality of treated water for a long time.

'WTS DF' softners are co-flow softners having sufficient space to back-wash the resin available in various models.

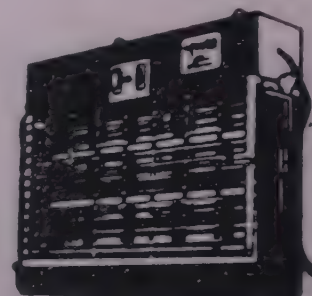
Besides these, Water Testing Services offer portable demineralisers, water treatment chemicals, bio-feed chemicals, etc.

For more details, write to :

Water Testing Services
4 Rambha, Dadabhai Rd.,
Vile Parle (W),
Bombay 400 056
Tel : 636 0589

INSECT KILLING MACHINES

Pest-O-Kill Electric Insect Killing Machines operate by attracting flying insects like flies, mosquitoes, moths, etc. with ultra violet light and killing them with electric shock. As no pesticides or chemicals are used, there is no danger of contaminating the surrounding articles or polluting the atmosphere. There are, therefore, no health hazards nor is there any recurring expense. Just switch on and forget it - the effect is continuous.



The machines are widely used in food and pharmaceutical industries, hotels, restaurants, snack bars, bottling plants, factory sheds, industrial and other canteens, dairies, hospitals, offices, homes and a wide variety of other establishments. In fact, they are a 'must' wherever an atmosphere free of the menace of flying insects is necessary.

The machines are available in a wide range of sizes so as to suit every need.

For details, contact:

Opel Industries,
235 A, Adhyaru Industrial Estate,
Sun Mill Compound,
Lower Parel,
Bombay 400 013.
Tel : 492 4123 / 492 6884
Fax : 492 6884.

WATER PURIFIERS

Alfa Water Purifiers & Appliances are now known as ACE Water Purifiers Pvt. Ltd. but their product remains the same : 100% safe water through their various models made as per W. H. O. specifications, using international time tested Quartz Glass technology, using heavy duty American Slimline UV lamps with a unique wiper assembly for self cleaning.

Ace Water Purifiers manufacture a complete range of Water Purification systems. The company has various models which range from 100 lts/hr. to 1,00,000 lts/hr. output capacity. Alfa Water Purifiers are made from 30.4 Grade stainless steel for long life and durability.

All systems are backed by a one year warranty. Reputed Customers include the Taj Group, Oberoi, Ramada, Leela, Windsor Manor, besides thousands of smaller hotels, restaurants, canteens etc.

For more details, write to :

Ace Water Purifiers Pvt. Ltd.,
222 Shah & Nahar A-2
Lower Parel,
Bombay - 400 013.
Tel : 4945957 / 4944942 Fax : 22-4954250

WATER LINE FILTER



Water Line Filter manufactured by cosywo Engineering Limited, removes sand, pipe slag and other impurities flowing along with water from the bore which creates Daghi in the fabric on beam Dyeing Rotary Flat Bed Screen printing machine, Tensitroll washing machine, Soaper Tanks etc. Impurities work as a grinding media which reduces life of the pump bearings, gland packing impellers of multistage pumps mechanical seals and Carbon bearings

The filter is fitted in the water line and is easily openable for cleaning and Maintenance free. Impurities are flushed out with ease.

For further details, contact :

Cosywo Engineering Company
16 Laxmi co-op. Industrial Estate, Ltd.,
Near Nagarwell Hanuman Mandir,
Amaraiwadi Rd., Ahmedabad - 380026.
Tel : 368168, 368000
Gram : COSYWO.

INFRA RED MOISTURE BALANCE

Mangal infrared moisture balance may be used to determine the moisture percentage in practically all organic and inorganic materials.

A Moisture balance operated at a warranted accuracy of .1% is installed below the drying chamber.

Mangal Moisture Tester meets the requirement of modern laboratory or processing control by supplying exact moisture values with good accuracy.

Mangal moisture balance is also very useful to check moisture in wheat, rice, all type of grains etc.



For more details, write to :

Mangal Instrumentation,
34, Ganesh Balar,
Jhansi - 284002
Tel : 3489
Gram : IMCE

KITCHEN EQUIPMENT

Vipul Engineering Equipment manufacture a wide range of kitchen equipment for Hotels, Restaurants, Clubs, Industrial Canteens & Fast Food Establishments.

Some of the products manufactured are : Bulk Cooker / Tea & Coffee boiler / Sink Unit / Work Table / Potato Peeler / Bain Marie with hot case / Cooking Gas Range / Chinese Cooking Range / Wet Grinder / Dough Kneader / Pick Up Counter / Chappati Plate Puffer / Deep Fat Fryer / Pizza Oven / Stock Pot / Salamander / Hot Food Cabinet / Rice, Dal, Sambar Vessels (Steam) / Storing Racks / Table with Seat / Chairs.

They also manufacture different types of trolleys, such as Garbage Bin Trolley / Uniform Trolley / Food Service Trolley / House Keeping Trolley / Flambe Trolley / Luggage Trolley / Tray Carrier Trolley / Barbecue Trolley / Room Service Trolley.

They also undertake fabrication of all metals for Pharmaceutical, Hospital & Dairy Industries as per customer specifications.

For more details, contact:

Vipul Engineering Equipment
13th Girish Kunj,
Rd. No. 3, Juhu Scheme,
Vile-Parle (W),
Bombay - 400 056.
Tel : 6145100 / 8080692
Fax : 022 - 4943409

AIR FLOW OVENS

Enviro-Pak, manufacturing division of Tech-Mark, Inc., has recently developed several new sizes in their unsurpassed line of horizontal air flow ovens for food processing of meat, fish and poultry items.

Horizontal air flow ovens are designed for use on food products that are best processed laid out on screens. The high volume air flow provides

greater uniformity and higher production rates than normal vertical air flow ovens.



Model CHU-350

The Model CHU-350 complete with microprocessor control, trucks, screens and smoke generator equipment for hot or cold smoking can be purchased for \$ 40,000.00. Model CHU-350, CHU-150 and CHU-500 sizes are now also available.

Write or call

Enviro-Pak

P. O. Box 1569, Clackamas,
Oregon 97015, U.S.A
Phone : (503) 655-7044,
Fax: (503) 655 6368.

SIFTER

M/s. United Technologie manufacture a range of specialised machinery for the beverage and food industry such as Planetary Mixer, Homogeniser, Paste and Liquid Filling Machines, Sifter (shown below), Rebbon Mill, Multi Mill as well as Conveyors.



Sifter

United Technologie can design and manufactures to cater to your specific requirements.

For more information, please contact :

United Technologie

Off : B 3/201, Ashokvan,
Borivali (E) Bombay 400 066.

Tel : Resi. : 8951133

Fact : Parekh Ind. Estate Gala No. 10 & 19
Chandansar Road, Virar (East), Thane 380 001.

ULTRA FILTRATION

Kumar Process Consultants manufacture a range of ultra filtration products for filtering liquids and gases. Their product range include Liquid Filters upto 0.1 micron used for chemicals, pharmaceuticals, process water, edible oils, etc. Air Filters upto 0.01 micron for instrumentation, electronics, pneumatic systems, pharmaceuticals; In-line Conical Filters (ILCF) for filtration upto 800 LPH with interchangeable porosities from 100 upto 0.2 microns, suitable for product filling and bottling lines, laboratories, etc. Stainless Steel Lab Filters ideal for laboratories, research centres, etc.

For further details, write to:

Kumar Process Consultants & Chemicals Pvt. Ltd.

230/4 Ashok House,
Behind Purnamal Delhiwala,
Linking Rd., Bandra (W),
Bombay 400 050
Tel : 6451964 / 6432512
Fax : (022) 6432512 / 6420637

BISCUIT/BREAD BAKING OVENS



"AIFSO" continuous conveyerised type gas and oil fired Biscuit Baking Ovens are designed to run on direct and indirect fired basis with efficient burners and uniform distribution of heat in the baking zone.

Specially the Indirect oil fired ovens are of most modern design suitable for all varieties of shortdough and harddough quality biscuits.

AIFSO ovens are used all over India and abroad by reputed companies like Parle, Britannia, Bakeman, etc.

The temperature profile for each variety of Biscuit is automatically maintained as per the requirement. AIFSO Biscuit/Bread baking ovens are more efficient in terms of baking performance and fuel consumption.

For more details, contact:

Aifso Enterprises

A/1, Veena Beena Apts.,
Sewri (W),
Bombay 400 015.

Tel Off. : 4137339 / 4130926

Res : 4137109 / 4134568 Fax : 91-22-4137339

P. J. PRINT MARK SCANNER

PS - 4



A MUST FOR:
WRAPPING MACHINE
F/F/S MACHINE
BLISTER PACKING MACHINE
BAG MAKING MACHINE
BISCUIT PACKING MACHINE
FLOW PACK MACHINE

An eye for precision

Designed for scanning of registration marks on printed films used by packaging industry - P.J. PRINT MARK SCANNER PS-4 is ideally suited for use in Form-Fill-Seal, wrapping, bagging or bagmaking machines

Salient Features

- No bulb as light source but green light emitting diode with 1,00,000 hours life.
- Free from ambient light disturbances
- High stability & repeatability for once

set combination even at low contrasts

- Single power supply
- Supply voltage 18 to 30 V.D.C
- Short circuit and over current proof
- Safety from wrong connections
- Directly Replaceable to Visolux RL-4
- Datalogic TL-10
- Sick NT-6

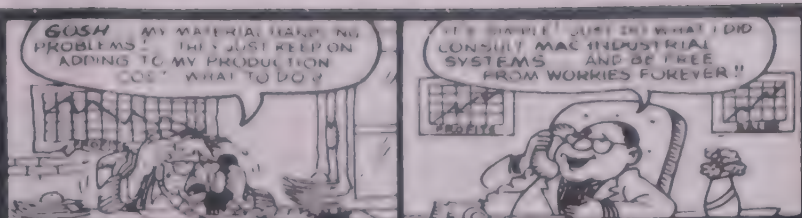
Specifications :

- Scanning Distance 10mm + 2mm
- Size of dash 1.5 - 4.5mm approx

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GODREJ SOAPS PVT. LTD., BOMBAY
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ORUM ENGINEERING PVT. LTD., BOMBAY
PRECISION GEARS PVT. LTD., BOMBAY

Manufacturers :-
P.J. Electronics
UNIT NO. A/24,
45 DR. AMBEDKAR ROAD,
PUNE-411001. TEL. 623710.



MAC INDUSTRIAL SYSTEMS

Bulk & Unit Material Handling Equipments, Systems & Spares

C/80, Sachdhara Society, Dada Bhai X Road No. 3,
Vile Parle (W), Bombay - 400 056.
Tel. 8324244



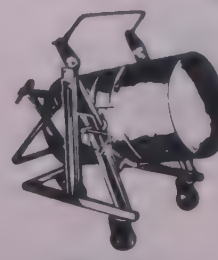
SUSPENSION CONVEYOR



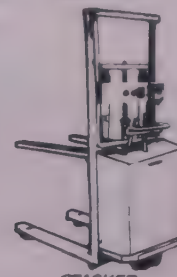
SLAT CONVEYOR



GRAVITY ROLLER CONVEYOR



DRUM JOCKEY



STACKER

We Offer Efficient Material Handling Systems with powered & non-powered equipments on Turn-Key basis

- Pallet Handling Systems • Belt/Chain/Slats/Screw/Flight Conveying Systems
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Our Clientele

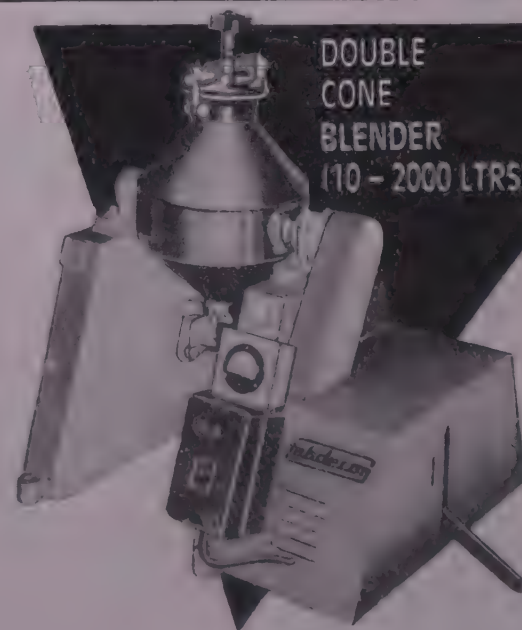
- Processing Industries • Food Processors • Stores & All Industries having Materials Movement

ENGINEERED EQUIPMENT FOR SOLIDS PROCESSING

Fabdecon

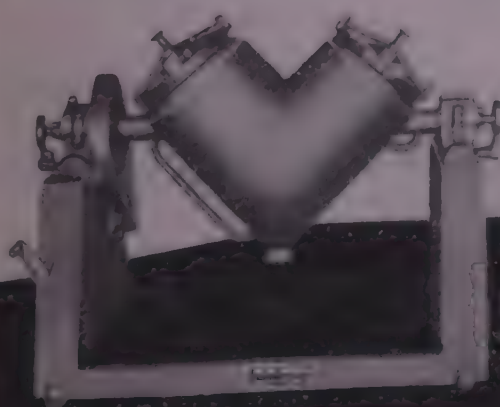
ENGINEERS

138, Damji Shamji Indl. Complex,
Off Mahakali Caves Road,
Andheri (E), Bombay - 400 093.
Phone Nos. : 8347952 / 8343179
Telex No. : 011-79194 FABD IN
Fax No. : 022 8345903



DOUBLE CONE BLENDER
(10 - 2000 LTRS.)

RIBBON BLENDER
(10 - 7000 LTRS.)



V BLENDER
(10 - 2000 LTRS.)

PLOUGHSHARE MIXER
(10 - 8000 LTRS.)



WEIGHING MACHINES

The company are well known manufacturers of weighing machines, filling machines and electronic scales & systems to meet any and every need.



For details, write to:

Accurate Weighing Machines Co.
Prabhatwadi
139 Motishah Lane
P. B. No. 6958
Byculla, Bombay 400 027
Tel : 3767308 / 2369 Grams: ACCUWEIGH

CROWN CAPS

The company manufactures crown fits to crimp carefully on every bottle head. ST's moulded PVC lined crown is designed to suit product's chemistry : soda, soft drink, beer, tomato ketchup, sweetened milk etc.

Crowns are produced in ST's modern, automatic plant considering operational requirement of high output filling / sealing lines at users' end. Lithographed as per your design.

Packing 7200 - 10000 crowns -- in polybag and then in corrugated carton.

Standard Tin Works also manufactures cans, containers and tinlets. Besides round, oval, rectangular, bamboo and square cans etc. being produced by the company on body makers and other highly speed machineries, ST also makes drawn cans by utilising MS/TFS/Tinplate or combination thereof considering end-use. Accordingly, process of lithography, varnishing and lacquering is applied.

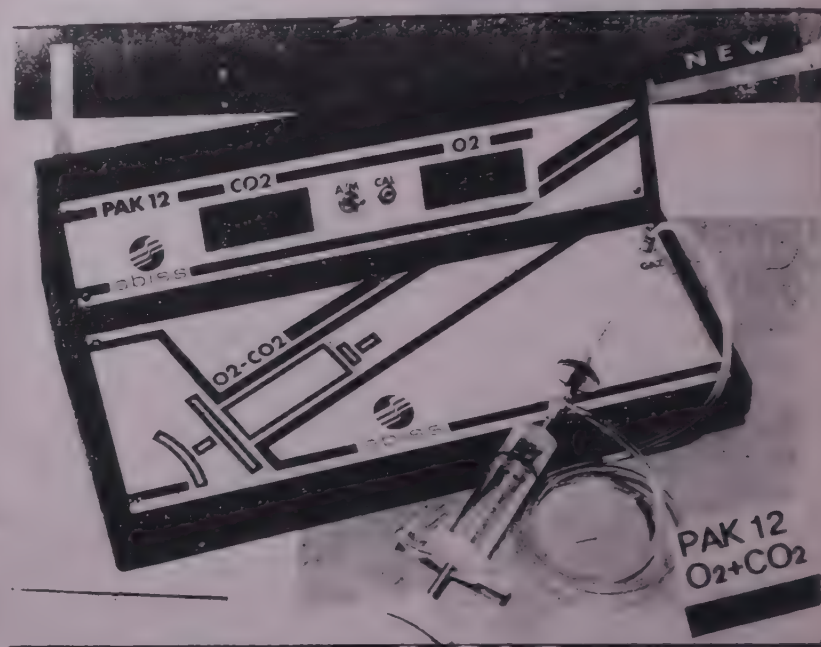
For details, write to:

Standard Tin Works
Standard House, Near Safed Pool,
Off Kurla-Andheri Road, Bombay 400 072.
Tel : 5112758 / 5163911 / 5163912 / 5163913
Fax : 91-22-5164851

ANALYSERS

Technovation are sole selling agents for M/s ABISS, France, manufacturers of oxygen and carbon dioxide analysers, most suited for food industry applications. ABISS has for its principal lines the following : Residual oxygen and CO₂ analysers to measure head space containing

modified atmosphere (O₂ & CO₂ with nitrogen in soft food pack, tincan and bottle); continuous controlling systems for O₂ and CO₂ for numerous industrial applications as grain storage in silos; and safety monitoring with respect to O₂ deficiency and injurious levels of CO₂.



For details, write to:

Technovation,
4 Paramel, St Cyril Road,
Bandra (West), Bombay 400 050.
Tel : 6400678
Fax : 91-22-6443425

AIRCONDITIONING / REFRIGERATION

General Airconditioning Co. design and build for you : Dairy Projects * Ice Cream Projects * Refrigerated Warehousing Projects.

They also undertake guaranteed repair and maintenance of Truck and Van Refrigeration, Walk-in Cooler and Freezer, Cold Storage, etc.

Walk - in Cooler / Freezer has insulated modular panels (polyurethane Sandwich panel) easy to assemble and expand, also for relocation. Temperature +15°C/40°C. The cooler is useful for storing frozen foods, ice-cream, perishable items, medicines, chemicals, etc.

For details, write to:

General Air Conditioning Co.
16/292 Bellasis Road,
Bombay - 400 008. INDIA
Tel : 3098635
Telex : 011-73471 VISH IN
Fax : 91-22-3072760

FREE PRODUCT REVIEW

If you have New Products or Processes, send us details of the same in 120 words and we will publish it in this section free of cost, along with one black & white product photograph.

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TO SUPPLIES & SERVICES FOR FOOD / BEVERAGE INDUSTRIES

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Amrutlal Bhurabhai & Co.,
Anand Bhawan, Princess St.,
Bombay 400 002. Tel : 2011023.
Gram : CHEMDRUGS.

Balaji Dye Chem, -- See under
"Acids".

Olin Chemicals, A-303
Padmavati Nagar, Gen. Arunkumar
Vaidya Marg, Goregaon (E),
Bombay 400 063. Tel : 8406988,
8413111 Fax : 8734332.

ACIDS

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zoic, Fumaric, Muriatic, Phos-
phoric, Tartaric, Gibberellic,
Tannic USP & Tech. etc.

Balaji Dye Chem, 5, Prafulla
Bhavan, 130, Khareghat Rd., Da-
dar, Bombay 400 014. Tel :
5610530/5611117/5321303 (R).
Gram : BALAJICHEM. Bombay
400 080.

Citurgia Biochemicals Ltd.,
Neville House, J. N. Heredia Marg,
Ballard Estate, Bombay 400 038.
Tel: 261 8071. Gram: CITURGIA.,
Bombay. Tlx: 11-86472 BOM IN

Sesu Trading Corporation, 4th
Flr., Sai Chambers, 367/369, Narsi
Natha St., Bombay 400 009. Tel:
3420832 / 3426402. Telex : 11-
72247 Fax: 11-3420832.

Thirumalai Chemicals Lim-
ited, Maalavika Centre, 5th Floor,
144, Kodambakkam High Road,
Madras 600 034. Tel: 8255755 Tlx:
041-5415 TCL IN.

ADDITIVES, FOOD & BEVERAGE

B. I. Mehta, 2-B, Ganga Vihar,
94, Kazi Sayed St., Bombay 400
003. Tel: Off: 344 5506/344 7879
Res: 644 2063 Tlx : C/o. 11-75617
MMCB IN Attn.: B. I. Mehta. Fax
: 00-91-22-8552708.

Burzin & Leons Agenturen Pvt.
Ltd., Readymoney Bldg. No. 1, Sir
Ratan Tata Marg, Tardeo Rd.,
Bombay - 400 034. Tel : 4944616,
4921255. Fax : 4930283

Ganesh Benzoplast Ltd., Ganesh
House, Marol, Andheri (E),

Bombay 400 059. Tel: (91) (22)
8382096/8383097/8384548. Tlx:
(081) 011-79164 / 83906 GNES
IN. Fax: (91)(22)2068475/
8391529.

Mittal Agency, 3, Rai Gopal
Shankar Lane, Naya Bazar,
Bhagalpur 812002. Tel : 20724.

Olin Chemicals -- See under
"Acetic Acid".

Sesu Trading Corporation, --
See under "Acids".

Thirumalai Chemicals Limited
-- See under "Acids".

Vidarbha Fruit Products Pvt.
Ltd., B/5, Rajdarshan, Opp. Plat-
form No.6, Thane (W). Tel :
504782, Fax : 539233.

Vin Flavours 'Viniketan' 1,
Krishna Society, Hari Bhakti Extn.,
Old Padra Rd., Baroda 390 015.
Tel: 541196/322048. Gram: VIN-
FLA.

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Polypak Products, 71/C Sundar,
N. G. Acharya Marg, Chembur,
Bombay 400 071. Tel : 5513727/
5519736.

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Manikant Brothers -- See under
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Unnati Corporation, 423-425,
GIDC Tele. Exch. Lane, Odhav,
Ahmedabad 382 415. Tel: 873434
/872277 Tlx: 121-6816 ANAR IN
Fax: 272-366505.

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Amit Fine Chem, 14, 3rd Dharia
House, Opp. Vinod Silk Milk,
Ashok Chakravati Rd., Kandivli
(E), Bombay 400101. Tel : 612
7988 / 889 1730.

Parul Enterprises, Dharia
House, Top fl., Opp. Vinod Mill,
A. C. Road, Kandivli (E), Bombay
400101. Tel : 6127988/8891730

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Cosywo Engineering Co., -- See
under "Chemical Plant & Equip-
ment".

Fabdecon Engineers, 138,
Danji Shamji Ind., Complex, Off.
Mahakali Caves Rd., Andheri
(East), Bombay 400 093. Tel:
8347952 / 8343179. Grams:
VACFILTER, Ghatkopar, Telex:
011-79194 FABD-IN.

Frigmaires Engineers, Janta Ind.
Estate, Gala No. 8, Tulsi Pipe Road,
Lower Parcel, Bombay 400 013. Tel:
4945624/4926159. Tlx: 011-75984
FRIG IN.

Lara Engineers, 19 Arunoday,
Alkapuri, Baroda 390005. Tel :
323157 / 327269.

Mamko Process Equipments --
See under "Emulsifiers".

United Technologie, -- See un-
der "Conveyors".

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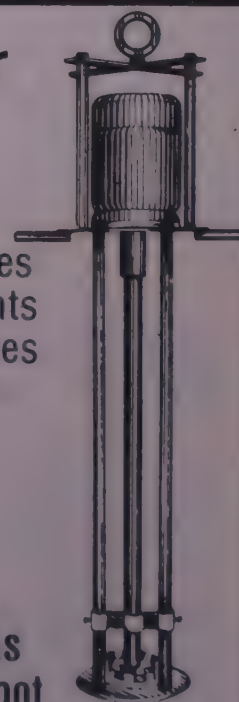
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Balaji Dye Chem -- See under
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Sonarome Chemicals Pvt. Ltd.,
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Peenya 2nd stage, Bangalore 560
058. Tel : 8394804/8395595. Fax:
3334802/2200016. Tlx : 845-8848.

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Amit Fine Chem. -- See under
"Agar Agar (Powder / Strips)".

Olin Chemicals -- See under
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Parul Enterprises -- See under
"Agar Agar (Powder / Strips)"

Sesu Trading Corpn. -- See un-
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Santacruz (East), Bombay 400 055.
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Baker Enterprises -- See under
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Cosywo Engineering Co. -- See
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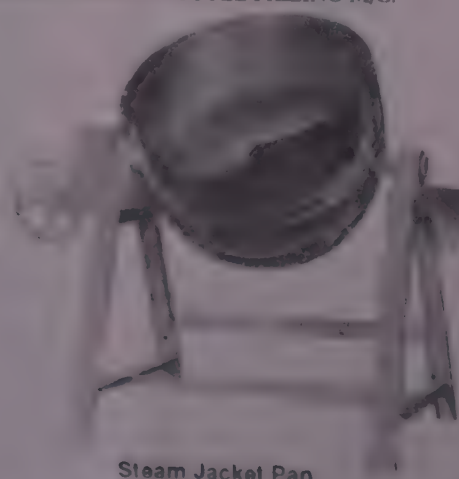
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J.T. Jagtiani -- See under "Machinery, Food & Beverage Processing".

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Geeta Food Engineering -- See under "Food Processing Equipment /Plants."

J. T. Jagtiani -- See under "Machinery, Food & Beverage Processing".

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J.M.B. Engineering, -- See under "Bakery/Biscuit Equipment".

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M. M. Chemicals -- See under "Acids".

Olin Chemicals -- See under "Acetic Acid".

Sesu Trading Corporation -- See under "Acids".

Thirumalai Chemicals Limited -- See under "Acids".

Uttam Corporation -- See under "Cellulose Products"

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Fabdecon Engineers -- See un-

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Frigmaires Engineers -- See under "Agitators"

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Ace International -- See under "Guar Gum".

Alok Chem Corporation -- See under "Guar Gum".

Amrutlal Bhurabhai & Co. -- See under "Acetic Acid".

Balaji Dye Chem -- See under "Additives, Food & Beverage".

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Sesu Trading Corporation -- See under "Acids".

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21415. Grams: FARM AID

Fabdecon Engineers -- See un-
der "Agitators"

Gupta & Company Ltd. -- See
under "Essential Oils"

CONFECTIONERY

MACHINES (See also under
"Machinery, Confectionery")

Eskeyar Engg. Co. (P) Ltd., 10/
5 Developed Plot, Ambattur Indl

Estate, Madras 600 058. Tel :
654137 / 652369. Fax : 499 1447.

CONSULTANCY & DESIGN

Dr. T. K. Food Consultants, 2A,
4th Floor, Lentin Chambers, Dalal
Street, Fort, Bombay 400 023. Tel
: 2657206 / 2651864.

K. X. Benedict, Kurupacherry
House, Ochanthuruth, Cochin 682
508. Tel : (91) (4852) 2407. Tlx :
0885 6304 CCCCIN. Fax: 91-484-
370 378.

CONTAINERS, PET/ PLASTIC/METAL

Swastik Industries 34/C,
Thakker Building, Ground Flr.,
Gala No. 4, Champsai Bhimji Road,
Next to Shrinivas Bldg., New Post
Office, Old Anjirwadi, Mazagaon,
Bombay 400 010 Tel: 8729366.

CONTRA-ROTARY MIXER

Cosywo Engineering Company
See under "Chemical Plant &
Equipment

Metal Plants, 2/17, Anupam Indl.
Estate, Lal Bahadur Shastri Marg,

Mulund, Bombay 400 080. Tel:
5614439/5610628.

CONTROLLERS

Flow, Liquid Level, Temp.
Misc.

Sakav Enterprises — See under
"Air Driers".

CONVEYOR, ROLLER

Ferro Foundries Private Ltd.,
Yelwal Road, Belvadi P.O., Mysore
571186, S. India. Tel: 42376 Gr:
FOUNDRY Tlx: HUNSPLY 0846-
224.

CONVEYORS

United Technologic, B3/201,
Ashokvan, Borivli (E), Bombay 400
066. Tel: 8951133. Fact: Parikh
Ind. Estate, Gala No. 2, 10 & 19,
Chandansar Road, Virar (E),
380001.

COOKING RANGE

Vipul Engineering Equipment -
See under "Kitchen Equipment".

COOLING TOWER PUMPS

Raj Pumps—See under "Boiler
Feed Pumps"

CORK LINERS

Vora Cork Industries Pvt. Ltd.,
Lobo Compound, Opp. Tip Top
Hotel, Sakinaka, Bombay 400 072.
Tel: 46342/43, Fax: 91-22-
5125370.

CORROSION INHIBITORS

Manikant Bros. — See under
"Anti Corrosion Chemicals".

COUPLINGS

Meritt Transmissions -- See
under "Power Transmission Prod-
ucts".

CREAM FILLING MACHINE

Frigmaires Engineers — See
under "Agitators"

United Technologic — See un-
der "Conveyor".

CREAM WAFER PLANT

New Indo International -- See
under "Pillow Pack Packing Ma-
chine".

CREAM OF TARTAR

Alok Chem Corporation, 406,
Goradia House, P.O.B. 13048, 100/
104, Kazi Syed Street, Bombay
400 003. Tel: 326390/325365 (R)
5610002/6238090.

Amit Fine Chem. -- See under
"Agar Agar (Powder / Strips)".

B.I. Mehta — See under "Ac-
ids".

Sesu Trading Corporation --
See under "Acids".

Thirumalai Chemicals Ltd. --
See under "Acids".

CROWN CAP PVC LINING MACHINE

Venus Packaging Services, 302
Palm Beach, Versova, Bombay 400
061 Tel: 6264835 / 632 1397 / 632
1398 Fact : 8113623/8110638 /
8110640 Fax : 627 1576.

CROWN CAP PUNCHING PRESS

Venus Packaging Services --
See under "Crown Cap PVC
Lining Machine".

CROWN CORKS

Standard Tin Works — See un-
der "Caps & Closures"

CULTURE MEDIA

Hi-Media Laboratories Pvt.
Ltd., 23, Vadwani Industrial Es-
tate, L.B.S. Marg. Bombay 400
086. Tel: 5150970/5151607 Fax:
00-91-022-5112468

DAIRY PLANT & EQUIPMENT

Alfa-Laval (India) Ltd., Bom-
bay - Pune Road, Dapodi, Pune 411
012. Tel: 86321 (8 Lines) Tlx: 0146-
219/259/326 ALL IN.

Continental Equipment India
Pvt. Ltd. - See under "Bakery /
Biscuit Equipment".

Frigmaires Engineers — See
under "Agitators"

Filtron Engineers Pvt. Ltd., C/
o. Sparc, 117-A, Vithalwadi Rad
Pune 411 030. Tel: (0212) 44068/
444079. Fax: (0212) 447949 Tlx:
01 45-323 TRON IN

Kishor Trading Corpn., Bussa
Udyog Bhavan, Unit No. 203,
Tokersey Jivraj Rd., Sewri,
Bombay 400 015. Tel : 4131617.

'METACOLOR', Shree Preco-
ated Steel Ltd. -- See under "Re-
frigeration Equipment & Plant".

Saffaire India — See under
"Air Conditioning/Refrigeration
Plant & Equipment".

Sangram Engineering Pvt. Ltd.
-- See under "Turnkey Plant /
Projects".

United Technologic — See un-
der "Conveyor".

DEHUMIDIFIERS

Arctic India Sales 20, Rajpur Road, Delhi 110054. Tel: 2522424/231129. Tlx: 031-78003 AISL IN

DESTONERS

John Fowler (India) Limited -- See under "Gravity Separators"

DETECTION

EQUIPMENT, Fire/Smoke, etc.

Subtronics, Kaliandas Udyog Bhavan, Unit No. 147, Near Prabhadevi P.O., Prabhadevi, Bombay 400 025. Tel: 4224461.

DIGITAL MOISTURE ANALYSER

Innovative Instruments, 125, Mahajan Society, Fatchganj, Vadodara 390 002. Tel: (0265) 21084

DISH WASHERS

Vipul Engineering Equipment -- See under "Kitchen Equipment"

DISPENSERS, BEVERAGES

Frigmaires Engineers -- See under "Agitators"

DOSERS

Micron -- See under "Water Sterilizers"

Water Testing Services -- See under "Water Treatment Equipment / Material"

DOUGH KNEADER

J. M. B. Engineering -- See under "Bakery/Biscuit Equipment"

DRYERS, OVEN/TRAY, ETC.

Fabdecon Engineers -- See under "Agitators"

Kailash Scientific Co., 28 Universal Indl. Estate, I. B. Patel Rd., Goregaon (E), Bombay 400 063. Tel.: 8734735, 8731836.

SSP Pvt. Ltd. -- See under "Evaporators"

Sakav Enterprises -- See under "Air Driers"

E. VANILLIN

Balaji Dye Chem -- See under "Additives, Food & Beverage"

ELECTRONIC SCALES

Accurate Weighing Machines -- See under "Weighing Machines"

EMULSIFIER, FOOD

Creative Aromatics -- See un-

der "Essences & Flavours"

Davar's M. P. Organics, Tansen Rd., Gwalior 474 002 Tel: 23741 / 21061 Gram: KOLDSTORE.

Kapadia Gum Industries, G. P. O. Box No. 1160, 3 Mint Road, 2nd Floor, Opp. G.P.O. Bombay 400 001. Tel: 261087/265073/267217. Grams: PHARMAGUM.

EMULSIFIERS

Cosywo Engineering Co. -- See under "Chemical Plant & Equipment"

Frigmaires Engineers -- See under "Agitators"

M. J. Shah & Co., 32, Hansraj Karamshi Building, 70 Masjid Bunder Road, Bombay 400003. Tel: 3752672/3491/0525 Tlx: C/o 73026. Gram: CAXCHEMIND. Fax: 91-22-3711845.

Mamko Process Equipment Manufacturers, Post Box No. 19001, Bombay 400 063. Tel: 8886309/8889913. Gram: MIXIN Bombay 400 063. Fax: (91 22) 8822757.

Remi Process Plant & Machinery Ltd., Cama Indl. Estate, Walbhat Lane, Goregaon (E), Bombay 400 063. Tel: 873 1998/4657. Tlx: 011-70118 RPML IN.

Sesu Trading Corporation -- See under "Acids"

United Technologie -- See under "Conveyor"

ENGINEERS & DESIGNERS CONSULTING (See also under "Consultancy & Design")

Cosywo Engineering Company -- See under "Chemical Plant & Equipment"

Forsberg Agritech (India) Pvt. Ltd. -- See under "Grain & Cereal Cleaning / Grading Machinery"

Frigmaires Engineers -- See under "Agitators"

M. F. Marketing Pvt. Ltd. -- See under "Autoclaves"

ENZYMES

Biocon India Pvt. Ltd., 20th Km-Hosur Rd., Hebbagodi 561 229, Bangalore Dist. Tel: 080-8422169 Gram: BLASE, Bangalore 34.

Olin Chemicals -- See under "Acetic Acid"

EPOXY COATING

Manikant Brothers -- See under "Anti-Corrosion Chemicals"

ESSENCES & FLAVOURS

Bush Boake Allen (India) Ltd., 1-5, Seven Wells Street, St. Thomas Mount, Madras 600 016. Tel: 431131 Grams: ABRACOL-MADRAS Tlx: 041 26058 BBA IN.

Creative Aromatics, No. 1239, 10th Main, Prakash nagar, Bangalore 560021. Tel: 322575. Tlx: 0845 - 2999. Fax: 0812 - 324848.

Feroze Foods & Flavours, 403, Central Tin Est., F. Kondeo Marg, Sussex Road, Byculia, Bombay 400 027. Tel: 3729724 / 3614972.

Harish C. Khosla & Co., Zinat Mahal, Lalkuan, P.O. Box 1328, Delhi 110 006. Tel: 7524803/733160 Gr: THYMOL Tlx: 62267 HCK IN

M. C. Davar Aromatics Pvt. Ltd., 266, B. J. Dadaji Marg, Hormazd Mansion III Floor, Opp Bhatia Hospital, Tardeo, Bombay 400 007. Tel: 359468 Tlx: (11) 85892 DAVR IN.

Sesu Trading Corporation -- See under "Acids"

Sonarome Chemicals Pvt. Ltd. See under "Aromatic Chemicals"

Universal Flavours & Fragrances, 133, New Apollo Estate, Mogra Village Road, Andheri (E), Bombay 400 069. Tel: 8322631/8200106. Gr: JEPYPATEL, Bombay 49.

Vin Flavours -- See under "Additives, Food & Beverage"

ESSENTIAL OILS

Bhagat Impex Pvt. Ltd., 164 Sitaram Podar Marg, 1st Fl., Bombay 400 002 Tel: 2086928 / 2016995 Tlx: 011-80056 BGIL IN.

Gupta & Company Ltd., XIV/294, Gali Mandi Pan, Sadar Bazar, Delhi 110006. Tel: 7774742 / 528923 / 527795 Tlx: 31-66075 GCPL-IN. Fax: 011-7519215 Cables: AROMA DELHI 110006.

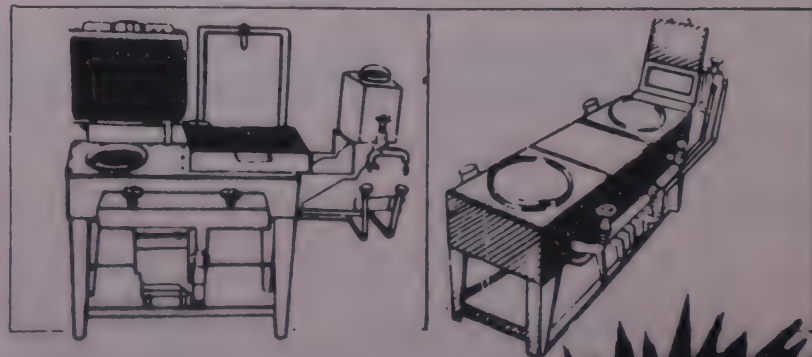
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Harish C. Khosla & Co. -- See under "Essences & Flavours".

L. B. Aroma & Chemicals, 4 Omex Chambers, Gr. flr., Rajeshwari Shahu Marg, (Telli Galli Road), Andheri (E), Bombay 400 069. Tel: 6121 258/613 3066. Gram: OIL TRADES, Bombay 57. Fax: 91-22-6111646. Tlx : 011-78159 FCS IN.

Olin Chemicals -- See under "Acetic Acid".

Sesu Trading Corporation -- See under "Acids".

EVAPORATORS

SSP Pvt. Ltd., 19 DLF Indl. Area II, 13/4 Mathura Rd., Faridabad 121003 Tel : 82-75441/8277730/8275968, Gram : ESESPEE. Tlx : 034-286 SSP IN

United Technologic -- See under "Conveyor".

EXTRUDERS

Dr. TK Food Consultants & Exporters -- See under "Consultancy & Design".

Fabdecon Engineers -- See under "Agitators".

FABRICATED EQUIPMENT

Cosywo Engineering Company -- See under "Chemical Plant & Equipment".

Fabdecon Engineers -- See under "Agitators".

Frigmaires Engineers -- See under "Agitators".

United Technologic -- See under "Conveyor".

Vipul Engineering Equipment -- See under "Kitchen Equipment".

FASTFOOD EQUIPMENT

Continental Equipment India Pvt. Ltd. -- See under "Bakery/Biscuit Equipment".

United Technologic -- See under "Conveyor".

FIBRE GLASS ADHESIVE TAPE

Unnati Corporation, 423-425 GIDC Tele. Exch. Lane, Odhav, Ahmedabad, 382415, Tel.: 873434/872277, Tlx.: 121-6816, ANARIN Fax : 272-873223.

FILLING & SEALING MACHINES

Accurate Weighing Machines

Co., -- See under "Weighing Scales".

Acmevac Sales Pvt. Ltd. -- See under "Bottle Washers & Rinsers".

Fabdecon Engineers -- See under "Agitators".

Frigmaires Engineers -- See under "Agitators".

Gansons Engineers Pvt. Ltd. -- See under "Form-Fill-Seal Machines".

Mamko Process Equipment Manufacturers -- See under "Emulsifiers".

Mittal Engineering Works, Plot No. C-30, Road 16, Wagle Industrial Estate, Thane 400 604.

Samarpan Fabricators Limited, Plot A-182/A-183, Road 16/Z, Wagle Industrial Estate, Thane 400 604. Tel: 5321842/5320373/5320822/5320029/5320730 Grams : PROPAC Tlx : 011-72329 SEL IN Fax : 91-22-5320033

Unique Flexo Packaging, Gala No. B/270, Joshi Wadi, Off Manpada Road, Dombivli (E), Bombay 421 201.

United Technologic -- See under "Conveyors".

FILM, MULTILAYER

Eco Plast Pvt. Ltd., Sona Udyog Bldg. No.4, 2nd floor, Parsi Pan-chayat Road, Andheri (E), Bombay 400063. Tel: 8325364/8325837 Tlx: 11-79171 VKEP IN Fax : 8366384

FILTERS

Kumar Process Consultants & Chemicals Pvt. Ltd., 230/4 Ashoka House, 'Swastik', Behind Puranmal Delhiwala Linking Rd., Bandra (W), Bombay - 400 050. Tel : 6432512/6420637/6451964 Tlx: 011-75973 KPCC IN. Fax : 091-22-6432512.

Otoklin, Plot No. 1, Shah. Indl. Area, V. Desai Rd., Andheri (W), Bombay 400 058. Tel : 6267476.

Watrion Water and Filter Engg. Pvt. Ltd. -- See under "Boilers".

FILTER PAPER

Lab Instruments -- See under "Heating Mantles".

FILTRATION SYSTEMS

Ion Exchange (India) Limited Ticcicon House, Dr. E. Moses Rd., Mahalaxmi, Bombay 400001. Tel.:

VIPUL ENGINEERING EQUIPMENT

13th Girish Kunj, Rd. No. 3,
Juhu Scheme, Vile-Parle (W).

Bombay - 400 056

Tel : 6145100, 8080692

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Kumar Process Consultants & Chemicals Pvt. Ltd. -- See under "Filters".

FLAVOURING EMULSIONS

M. C. Davar Aromatics Pvt. Ltd. -- See under "Essences & Flavours".

FLUID BED DRYERS

Pharmaco Machines, Ground Floor, Pandit House, Behind Nagrik Stores, Station Road, Thane 400 601. Tel : 5332245 / 5463722 Fax: 91-22-5331084.

FLY KILLERS, ELECTRIC

Opel Industries 235-A, Adyar Industrial Estate, Sun Mill Compound, Lower Parel, Bombay 400 013. Tel; 4924123/4926884.

FOOD COLOURS (See also "Colours, Food & Beverage")

Bush Boake Allen (India) Ltd., -- See under "Essences & Flavours".

Hickson & Dadajee Limited, -- See under "Colours, Food & Beverage".

Vino Synth Chem Pvt. Ltd., 404 Bezzola Commercial Centre, Sion Trombay Road, Chembur Bombay 400 071. Tel : 5522539/ 5528958 Cable : VINOBIN. Fax : 5522539.

FOOD PROCESSING EQUIPMENT/ PLANTS

Cantech Machines -- See under "Can Closing & Seaming Machine".

Continental Equipment India Pvt. Ltd. -- See under "Bakery/ Biscuit Equipment".

Fabdecon Engineers -- See under "Agitators".

Geeta Food Engineering, Ashirwad Complex, Vashi Village, Opp. Starling Hospital, Gala No. 2, New Bombay 400 703. Tel : 022-7667069.

Hi-Tech Systems, 80, Hardwar Road, Dehradun 248 005. Delhi Office : C-9B, Gangotri Enclave, Alakhnanda, Kalkaji, New Delhi 110 019. H.O. 25853 D.O. : 6436772. Gr: ATMA

New Indo International -- See under "Pillow Pack Packing Machines".

Metal Plants -- See under "Contra-Rotary Mixers".

'METACOLOR', Shree Precoated Steel Ltd. -- See under "Refrigeration Equipment & Plant".

Sangram Engineering Pvt. Ltd. -- See under "Turnkey Plants / Projects".

FORM-FILL-SEAL MACHINES

Gansons Engineers Pvt. Ltd., 118/121 Swastik Chambers, Off. Sion-Trombay Rd., Chembur, Bombay 400 071. Tel : 524548/ 524967.

New Indo International -- See under "Pillow Pack Packing Machines".

Padmatex Engineering Ltd., Jyoti Studio Compound, 1st Floor, K.B.A. Irani Bridge, (Kennedy Bridge), Bombay 400 007. Tel : 3860350, 3875005 Fax : 3878439 Tlx : 011-76966.

Unique Flexo-Packaging, Gala No. B-270, Off Manpada Road, Opp. Kasturi Plaza, Joshiwada, Dombivli (E) 421 201. Tel: 5785723.

FRUIT JUICE BOTTLING PLANT

Sangram Engineering Pvt. Ltd. -- See under "Turnkey Plants / Projects".

Fruit Processing Plant

Sangram Engineering Pvt. Ltd. -- See under "Turnkey Plants / Projects".

FUMARIC ACID

Amit Fine Chem. -- See under "Agar Agar (Powder / Strips)".

Ganesh Dehydride Ltd. -- See under "Additives, Food & Beverage".

Olin Chemicals -- See under "Acetic Acids".

GELATINE

Amit Fine Chem. -- See under "Agar Agar (Powder / Strips)".

GHEE FILTRATION UNITS

Codex Enterprises -- See under "Batch Coder".

GLASS & GLASSWARES

R. G. Glass Agency -- See under "Bottles & Jars, Glass".

GLASS FABRICS, PTFE COATED

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Balaji Dye Chem -- See under "Additives, Food & Beverage".

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GRAVITY SEPARATOR

Goldin (India) Equipment Pvt. Ltd. -- See under "Cleaning / Grading Machinery".

John Fowler (India) Limited, Sarjapur Road, Bangalore 560034. Tel: 5530026 Fax: 91-08-5533228 Tlx : 08452545.

GRINDER, WET & DRY

Sesa Pulverisers, Kala Kila Road, Dharavi, Bombay 400 017. Tel: 4121434.

GRINDING MILLS

Frigmaires Engineers -- See under "Agitators".

Kaps Engineers, 831, GIDC Indl. Estate, Makarpura, Vadodara 390 010. (Gujarat). Tel: 43178. Grams: KAPS. Tlx: 0175-533 MI-CON IN. Fax: 0265-43679.

Sesa Pulverisers -- See under "Grinder, Wet & Dry".

GUAR GUM

Ace International, 13/21, Laura Bldg., 1st Floor, 1st Dhobi Talao Lane, Bombay - 400 002. Tel: (O) 2051413 / 2058169 Fax: 2089282 Tlx: 011-86654 PCOK IN.

Alok Chem Corporation, 406, Goradia House, P.O. Box No. 13048, 100/104, Kazi Syed Street, Bombay 400 003. Tel: 3426390/ 5365. Res: 5648355. Fax: 91-22-3426390.

Kapadia Gumchem Industries, 3, Mint Road, 2nd Floor, Room No. 30, Opp. G.P.O. Box No. 1160, Bombay 400 001 Tel: 2615073/ 2617217 Gram: PHARMAGUM. Fax: 91-22-2619423 Tlx : 011-86630 KGI IN

Swastik Gum Industries (India) 328 G. V. M. M., Vasahat, Odhav, Ahmedabad 382415. Tel: 870063/ 870064 / 870065 Tlx: 011-73265 KATR IN (Bombay).

GUAR GUM POWDER
Ace International -- See under "Guar Gum".

Kapadia Gumchem Industries, -- See under "Guar Gum".

GUM ACCACIA
Ace International -- See under "Guar Gum".

Alok Chem Corp. -- See under "Guar Gum".

Kapadia Gumchem Industries, -- See under "Guar Gum".

GUM ALGEL
Alok Chem Corp -- See under "Guar Gum".

GUM ARABIC
Ace International -- See under "Guar Gum".

Alok Chem Corp. -- See under "Guar Gum".

Balaji Dye Chem -- See under "Acids".

Kapadia Gumchem Industries, -- See under "Guar Gum".

GUM KARAYA
Alok Chem Corporation -- See under "Guar Gum".

GUMS, FOOD
Alok Chem Corp. -- See under "Guar Gum".

Burzin and Leons Agenturen Pvt. Ltd -- See under "Additives, Food & Beverage"

Kapadia Gumchem Industries - See under "Guar Gum".

Olin Chemicals -- See under "Acetic Acid"

GUM TRAGACANTH
Ace International -- See under "Guar Gum".

Alok Chem Corporation -- See under "Guar Gum".

HEADSPACE GAS ANALYSERS
Technovation -- See under "Analysers".

HEATING ELEMENTS
Subash Gupta & Co., 100 Arya Nagar, Ghaziabad 201009. Tel: 871471/8723893/2293795 (Delhi)

HEAT EXCHANGERS
Arctic India Sales -- See under "Dehumidifiers".

HEATING MANTLES
Lab Instruments, Ratnadeep, 1st Floor, 78, B. Jagannath Shankar Seth Rd., Behind Panchratna, Near Roxy, Opera House, Bombay 400 004. Tel: 3610973. Fax : 3634619.

Manikant Bros. -- See under "Anti-Corrosion Chemicals".

Subhash Gupta & Co., -- See under "Heating Elements"

HOMOGENIZERS
Cosywo Engineering Co. -- See under "Chemical Plant & Equipment".

Frigmaires Engineers -- See under "Agitators".

Goma Engineering Pvt. Ltd. B/9, Kayteco Industrial Estate, Majiwada, Thane 400 601. Tel : 5340875/5346436/5341937. Tlx : 011-72389 TCWE IN Fax : 91-22-5342682.

J. T. Jagtiani -- See under "Machinery, Food & Beverage Processing".

Mamko Process Equipment Manufacturers -- See under "Emulsifiers".

United Technologie -- See under "Conveyors".

HUMIDIFIERS
Arctic India Sales -- See under "Dehumidifiers".

ICE CREAM CONE MACHINES
R & D Engineers, A-41/1, I.D.A. Kukatpally, Phase II, Road No.4, Hyderabad 500 037 Tel : 040-279121. Fax : (842) 841697

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Subtronics, Kaliandas Udyog Bhavan, Unit No. 147, Near Prabhadevi H.P.O. Bombay 400 025. Tel : 4224461/4303047

INDUSTRIAL HEATERS
Subash Gupta & Co. -- See under "Heating Elements".

INSECT KILLERS (INSECTOCUTORS, ELECTRIC)
Opel Industries -- See under "Fly Killers, Electric".

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Biocon India Pvt. Ltd. -- See under "Enzymes".

IQF SPIRAL FREEZER

General Air Conditioning Co. -- See under "Walk-in Cooler".

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Rajdeep Plastics, 17 Jamnadas Indl. Estate, Dr. R.P. Road, Opp. Jawahar Talkies, Mulund (W), Bombay 400 080. Tel : 5641972 Fax : (0091) 5645833.

JUICE EXTRACTOR

Geeta Food Engineering -- See under "Food Processing Equipment /Plants".

KETTLES (STEAM JACKETED)

Continental Equipment India Pvt. Ltd. -- See under "Bakery/Biscuit Equipment".

Geeta Food Engineering -- See under "Food Processing Equipment /Plants".

KHOA MAKING MACHINES

Varsha Machinery Corporation, C-6, Shivaji Stadium, Mangalwar Peth, Kolhapur 416012. Tel: 20674 Gram : VARSHA CORP.

KITCHEN EQUIPMENT

Advance Equipments Co. -- See under "Air Conditioning & Refrig. Plant/Equip."

Continental Equipment India Pvt. Ltd. -- See under "Bakery/Biscuit Making Equipment"

Dairy Den (India) Pvt. Ltd., (Representing Zanussi Grandi Impianti (Italy) -- See under "Ice cream Equipment".

Frigmaires Engineers -- See under "Agitators".

Vipul Engineering Equipment, 13th Girish Kunj, Rd. No. 3, Juhu Scheme, Vile Parle (W), Bombay 400 056. Tel : 6145100, 8080692 Fax : 022-4943409.

KNEADERS

Fabdecon Engineers -- See under "Agitators".

Frigmaires Engineers -- See under "Agitators".

Vipul Engineering Equipment -- See under "Kitchen Equipment".

LABEL GUMMING MACHINE

Jacsons Engineers -- See under "Label Printing Machine".

LABELLING MACHINES

J. T. Jagtiani -- See under "Machinery, Food & Beverage Processing".

Lab Instruments -- See under "Heating Mantles".

Maharshi Udyog, 4 Ruchi, 36 Swastik Society, Navrangpura, Ahmedabad 380099. Tel : 409183 / 452456 Fax : 0272 - 425456

LABEL PRINTING MACHINE

Codex Enterprises -- See under "Batch Coder".

Jacsons Engineers, Phase 4, Plot No. 4701, G.I.D.C. Ind. Estate, Vatva, Ahmedabad 382 445. Tel: 830156 Gram : JALDEEP Fax : 91-079-833408.

LABORATORY EQUIPMENT

Lab Instruments -- See under "Heating Mantles".

United Technologie -- See under "Conveyor".

LACTIC ACID

Balaji Dye Chem -- See under "Additives, Food & Beverage".

Lactochem Ltd., 18 Venu Reddy st., Guindy, Madras 600 032. Tel : 044-2340789 Gr : LACTOCHEM.

Parul Enterprises -- See under "Agar-Agar (Powder / Strips)"

Sesu Trading Corp -- See under "Acids".

LEMON OIL

Olin Chemicals -- See under "Acetic Acid".

LIME OIL

Olin Chemicals -- See under "Acetic Acid".

Southern Citrus Products (P) Ltd. -- See under "Pectin".

LIQUID GLUCOSE

Olin Chemicals -- See under "Acetic Acid".

LUG CAP SEALING MACHINE

Raj Products & Equipment, P. O. Box 8075, Bombay 400056. Tel : 8192250, 8192750. Res: 6102035, Fax : 8375628.

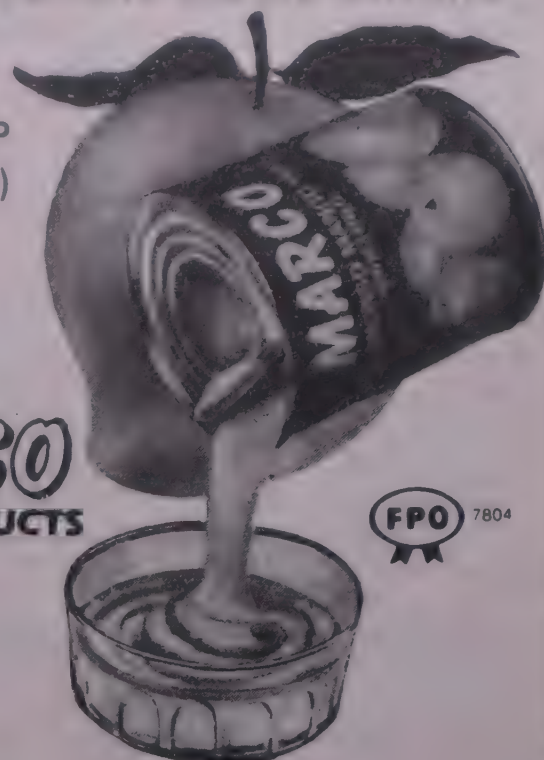
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Tel.: 3724633, 3724636, 3728033
Fax: 3751519

Factory:
Karanjari, Sangameshwar,
RATNAGIRI 415 803
Tel.: 224

MACHINERY, CONFECTIONERY

Continental Equipment India Pvt. Ltd. -- See under "Bakery/Biscuit Equipment"

Fabdecon Engineers -- See under "Agitators".

Frigmaires Engineers -- See under "Agitators".

United Technologie -- See under "Conveyor".

MACHINERY, DAIRY PROCESSING

Fabdecon Engineers -- See under "Agitators".

Filtron Engineers P. Ltd., SPARC, 117-A, Vithalwadi Road, Pune 411 030. Tel: 0212/440068

Frigmaires Engineers -- See under "Agitators".

United Technologie -- See under "Conveyor".

MACHINERY, FOOD & BEVERAGE PROCESSING

Fabdecon Engineers -- See under "Agitators".

J. T. Jagtiani, National House,

Tulloch Road, Apollo Bunder, Bombay 400 039. Tel: 2020028/2021433.

Saffaire India -- See under "Air Conditioning/Refrigeration Plants & Equipment".

United Technologie -- See under "Conveyor".

MACHINERY, PACKAGING

Aarkey Industries, 1, Hormuzd, 131, August Kranti Marg, Bombay 400 036. Tel: 367-0537, 367-5277 Gram: CRAFTWORLD.

Frigmaires Engineers -- See under "Agitators".

Ganga Singh Sukhwinder Singh & Sons -- See under "Canning Machinery & Plants".

Kaps Engineers -- See under "Grinding Mills".

Monga Packaging Pvt. Ltd., Box No. 17622, Mamlatdar Wadi Road, Malad (W), Bombay 400 064. Tel: 8821334/8821662.

Package India, W-115 A, III Avenue Anna Nagar, Madras 600040.

Padmatex Engineering Ltd. --

See under "Form-Fill-Seal Machines".

Pakona Engineers (India) Pvt. Ltd., 22-D, Wadia Charities Bldg., 2nd Floor, S. A. Brelvi Street, Fort, Bombay 400 023. Tel: 2872181/2874642.

Production Engg. Consultants - See under "Pillow Pack Machines".

R. G. K. Enterprises, Madhu Kunj, Vinod Baug, Juhu-Line, Block No. 12, Ground Floor, Andheri (W), Bombay 400 058.

Samarpan Fabricators Limited -- See under "Filling & Sealing Machines".

Subash Gupta & Co. -- See under "Heating Elements"

Unique Flexo Packaging -- See under "Automatic Form-Fill-Seal Machines".

MACHINERY, PHARMACEUTICAL/CHEMICAL

Advance Equipment Co. -- See under "Air Conditioning/Refrigeration Plant & Equip."

Fabdecon Engineers -- See under "Agitators".

J. T. Jagtiani -- See under "Machinery, Food & Beverage Processing".

MACHINERY, WRAPPING

R. G. K. Enterprises -- See under "Machinery, Packaging".

MAGNETIC SEPARATORS

Perfect Magnets Pvt. Ltd., 345, A. R. Street, Near Crawford Market, Bombay 400 003. Tel : 3420065/3426196-97 Fax : 91-22-208 3184. Tlx: 011-86942 CLNC IN ATT. PERFECT.

MALIC ACID

Olin Chemicals -- See under "Acetic Acid"

MALT EXTRACT

Amit Fine Chem -- See under "Agar Agar (Powder/Strips)"

Balaji Dye Chem -- See under "Additives, Food & Beverage".

Olin Chemicals -- See under "Acetic Acid".

MALTODEXTRINE

Olin Chemicals -- See under "Acetic Acid"

MATERIAL HANDLING SYSTEMS

Frigmaires Engineers -- See under "Agitators".

Goldin (India) Equipment Pvt. Ltd. -- See under "Cleaning/Grading & Machinery".

Mac Industrial Systems, C/80, Snehdhara Society, Dadabhai X Road No. 3, Vile Parle (W), Bombay 400 056. Tel : 8324244.

United Technologie -- See under "Conveyor".

METERING PUMPS

Jagdish Engg. Works -- See under "Pumps".

MILK / MILK PRODUCTS PROCESSING PLANT

Sangram Engineering Pvt. Ltd. -- See under "Turnkey Plants / Projects".

MINERAL WATER FILLING PLANT

Venus Packaging Services -- See under "Crown Cap PVC Lining Machine".

MINT OIL

Bhagat Impex Pvt. Ltd. -- See under "Essential Oils".

MIXERS, INDUSTRIAL

Baker Enterprises -- See under "Bakery / Biscuit Equipment".

Cosywo Engineering Company -- See under "Chemical Plant & Equipment".

Fabdecon Engineers -- See under "Agitators".

Frigmaires Engineers -- See under "Agitators".

Metal Plants -- See under "Contra-Rotary Mixers".

Remi Process Plant Ltd. -- See under "Emulsifiers".

United Technologie -- See under "Conveyor".

MIXERS, POWDER & PASTE

Cosywo Engineering Co. -- See under "Chemical Plant & Equipment".

Fabdecon Engineers -- See under "Agitators".

Frigmaires Engineers -- See under "Agitators".

Metal Plants -- See under "Contra-Rotary Mixers".

United Technologie -- See under "Conveyor".

MUSHROOM PROCESSING PLANT

Sangram Engineering Pvt. Ltd. -- See under "Turnkey Plants / Projects".

OIL FIRED BOILER

Cinni Engineering Pvt. Ltd. -- See under "Boilers".

Kalpna Boilers & Chemical Plants Mfg. Co. -- See under "Boilers".

OIL SEEDS CLEANING AND GRADING MACHINERY

Forsberg Agritech (India) Pvt. Ltd. -- See under "Grains & Cereals Cleaning / Grading Machinery".

L. B. Aroma Chemicals -- See under "Essential Oils".

ORANGE OIL

Balaji Dye Chem -- See under "Additives, Food & Beverage".

Sesu Trading Corp. -- See under "Acids".

OVENS, BISCUIT & BAKING

Admir Engineers -- See under "Bakery/Biscuit Equipment".

Aifso Enterprises, A/1, Veena Beena Apts., Sewri (W), Bombay 400 015 Tel. Off: 4137339/4130926 Res: 4137109/4134568 Fax: 91-22-4137339.

Baker Enterprises -- See under "Bakery / Biscuit Equipment".

Continental Equipment (India) Pvt. Ltd., -- See under "Bakery / Biscuit Equipment".

Grovers Pvt. Ltd. -- See under "Bakery / Biscuit Equipment".

OVENS/ TRAY DRYERS (See also "Dryers, Ovens/ Tray, etc.,")

Continental Equipment India Pvt. Ltd. -- See under "Bakery/ Biscuit Equipment"

Frigmaires Engineers -- See under "Agitators".

Kailash Scientific Co., 28, Universal Ind'l Estate, I. B. Patel Road, Goregaon (E), Bombay 400 063. Tel: 8734735/8731836.

Manikant Bros. -- See under "Anti-Corrosion Chemicals".

Sakav Enterprises -- See under "Air Driers".

Thermal Instruments & Equip-

ments, 2-1-478 Nallakunta University Road, Hyderabad 500044. Tel: 41720.

PACKAGING FILM

Plastic International -- See under "Packaging Material".

PACKING MACHINERY

Ebrahimjee Essabhai & Sons, 11 Old Hanuman Lane, Princess St., Bombay 400002. Tel: 2011694.

Pretty Packwell Pvt. Ltd., 173 Parakh Nagar, S. V. Rd., Kandivali (W), Bombay 400 067. Tel : 8050934 / 8055904.

Rishabh Automation, Rishabh, 28/10 Kothrud, Near Tejas Society, Pune 411029. Tel : 369693. Fax : (91) 212-662210.

Selall, 'Gectanjali' 9 Deccan College Road Pune 411006. Tel : 668369.

PACKAGING MATERIAL

Fine Plast Industries Pvt. Ltd., Sarang Street, Taher Bldg, 1st Flr., Bombay 400 003. Tel: 329303/345075. Grams: POLUDRUMS.

Package India, No. 4A (K.G.) Street, Mathiazhakan Nagar, Padi, Madras 600050. Tel : 6257260.

Plastic International, B/13, Nanddham Indl. Estate, Marol, Andheri (E), Bombay 400 059. Tel: 8320798/8322683 Tlx: 11-79498 Gr: Interplast Fax: (011) 8366237.

PALLET HANDLING SYSTEM

Mac Industrial Systems -- See under "Material Handling System".

PARAFFIN WAX

Balaji Dye Chem -- See under "Additives, Food & Beverage".

PARBOILING PLANTS

Agro Engineering Products. (Delhi) P. Ltd. 38, South Extn. Part I, New Delhi 110049. Tel: 698928, 617928.

PASTEURIZERS

MF Marketing Pvt. Ltd., B-15, Arjun Centre, B. S. Devshi Marg, Govandi, Bombay 400088. Tel : 5557515/5560947 Tlx : MF IN 76502 Fax : 91-22-5560569.

PASTE & LIQUID FILLING MACHINE

United Technologie -- See under "Conveyor".

PECTIN

Amit Fine Chem. -- See under "Agar-Agar (Powder/Strips)".

Balaji Dye Chem -- See under "Additives, Food & Beverage".

Olin Chemicals -- See under "Acetic Acid".

Parul Enterprises -- See under "Agar Agar (Powder/Strips)".

Sesu Trading Corporation -- See under "Acids".

Southern Citrus Products (P) Ltd., Gudur 524101, Nellore Dist., A. P. Tel : 21328 / 21528.

PILLOWPACK PACKING MACHINES

New Indo International, 135 -A Begumpur, Malviya Nagar, New Delhi - 110 017. Tel : 6445315 / 6453289 / 6470641.

Production Engineering Consultants, 206, Aakaar, Kalyan Complex, Yari Rd., Versova, Bombay 400 061. Tel : 6290161, 6271021.

PLANETARY MIXER

Cosywo Engineering Company -- See under "Chemical Plant & Equipment".

Fabdecon Engineers -- See under "Agitators".

United Technologie -- See under "Conveyor".

PLATINUMWARE

Lab Instrument -- See under "Heating Mantles".

POLYETHYLENE COATED PAPER

Guardian Plasticote Limited, 12, HOCHIMINH Sarani, Calcutta 700071. Tel: 242-7676/242-9914/242-4795, 242-7675. Tlx: 21-7459 GARD IN. Fax : 91-33-242 2088.

POTASSIUM META BI SULPHITE

Balaji Dye Chem -- See under "Additives, Food & Beverage".

Sesu Trading Corp. -- See under "Acids".

POTATO STARCH

KMC-Narayan, C/o. Narayan & Co., Mangalam Building, Kankuwadi, P. M. Road, Vile Parle (E), Bombay-400 057. Tel. : 614 5952/6148226 Fax : 6101243.

POUCH FILLING MACHINES

Unique Flexo Packaging -- See under "Automatic Form-Fill-Seal Machines".

POWDER/PASTE BLENDERS

Mamko Process Equipments Manufacturers -- See under "Emulsifiers".

POWDER FILLING MACHINE

Frigmaires Engineers -- See under "Agitators".

POWER TRANSMISSION PRODUCTS

Meritt Transmissions, 157/159 Narayan Dhuru Street, Ground Floor, Behind Nagdevi Street, Bombay 400 003. Tel : 3428342 / 3411197 / 3444956 / 3442857. Gr.: SEAWIZARD. Fax : 91-22-4078268.

PRESSURE GAUGES

Goma Engineering Pvt. Ltd., B-9, Kaytceco Ind. Estate, Behind Paper Products, Majiwada, Thane 400 601. Tel: 501424 / 591514.

PROCESS PLANT EQUIPMENT

Mamko Process Equipments Manufacturers -- See under "Emulsifiers".

PROPYLENE GLYCOL

Olin Chemicals -- See under "Acetic Acid".

PULPER

Gecta Food Engineering -- See under "Food Processing Equipment / Plant".

PULVERISERS

D. P. Pulveriser Works, Modi & Modi Bldg., 76, Nagindas Master Road Extn., Opp. Maharashtra State Co-op. Bank Ltd., Fort, Bombay 400 023. Tel: 276435/274901 Grams : GRANULE

Frigmaires Engineers -- See under "Agitators".

Sesa Pulverisers -- See under "Grinder, Wet & Dry".

United Technologie -- See under "Conveyor".

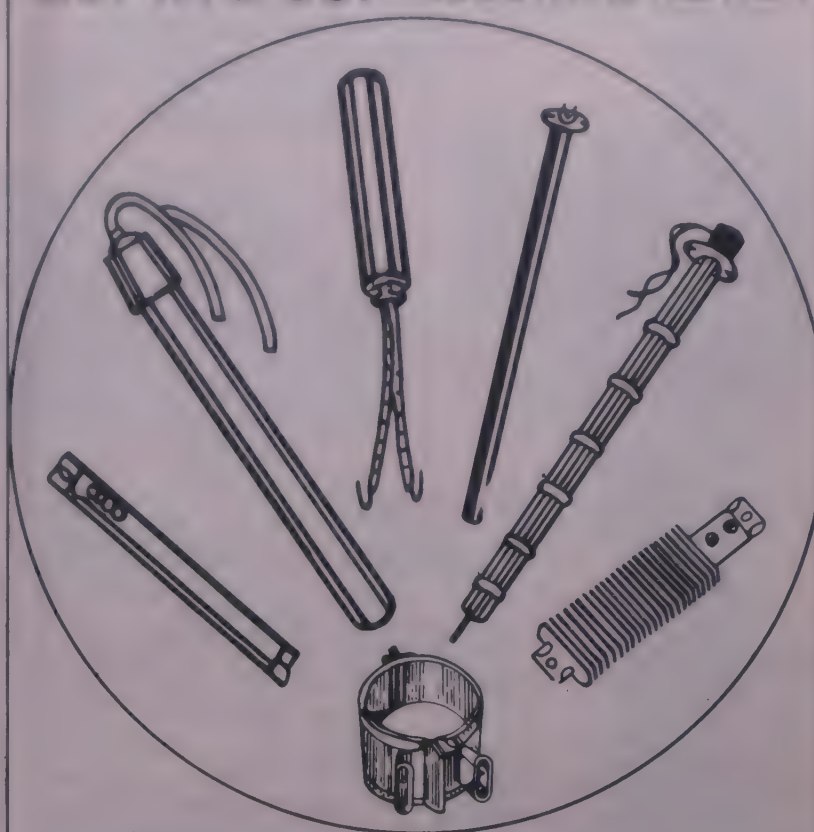
PUMPS

Beer, Carbonator, Centrifugal, Rotary, Vacuum etc.

Elmach Engineering Co., 410, Hill View Co-op. Ind. Estate, Off L.B.S. Marg, Ghatkopar (W), Bombay 400 086. Tel: 270160/272760.

Flocon Equipments, C 11/7 Bonanza Indl. Estate, Ashok

SUBASH GUPTA & CO. INDUSTRIAL HEATER



FAC. 46B, JAGAT PURI, MANDOLI ROAD, SHAHDARA, DELHI-93 PH.-2293795

OFF. 100, ARYA NAGAR, GHAZIABAD-201009 PH.-8723893

Chakravati Rd., Kandivli (E), Bombay 400 101. Tel : 8892017 / 8823055.

Jagdish Engineering Works. 7/ 2, Rocky Industrial Estate, I. B. Patel Road, Goregaon (E), Bombay 400 063. Tel: 8731134.

SSP Pvt. Ltd. -- See under "Evaporators"

Technomech Pumps, Bombay Wire Compound, Gala No. 10, I. B. Patel Rd., Goregaon (E), Bombay 400 063.

PUMPS, VARIABLE SPEED DRIVE

Raj Engineers, 5/3 Raj Apts. L. B. S. Marg, Ghatkopar (W), Bombay 400 086.

REACTORS

Fabdecon Engineers -- See under "Agitators".

REFRIGERATION EQUIPMENT / PLANT

Continental Equipment India Pvt. Ltd. -- See under "Bakery/ Biscuit Equipment".

General Airconditioning Com-

pany -- See under "Walk in Cooler".

'Metacolor', Shree Precoated Steel Ltd., Hanuman Bldg., 308 Perin Nariman Street, Behind RBI, Fort, Bombay 400001. Tel : 2662540/2661232. Tlx: 011-82793 YOGI IN Gram: AJMERABILD. Fax : 91-22-266 1878.

Transair -- See under "Airconditioning / Refrigeration Plant & Equipment".

RENNET

Olin Chemicals -- See under "Acetic Acid".

RIBBON MILL

Fabdecon Engineers -- See under "Agitators".

United Technologie -- See under "Conveyor".

ROLLED SUGAR CONE MACHINERY

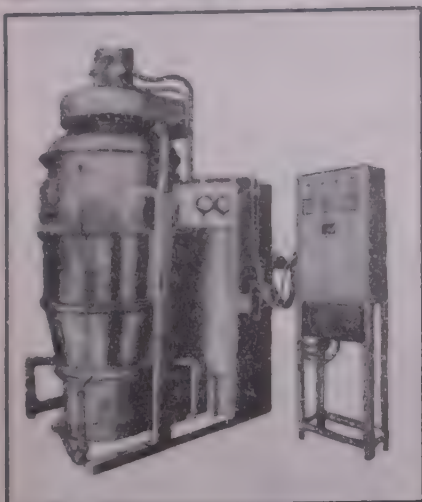
R & D Engineers -- See under "Icecream Cone Machinery".

SEALING MACHINES

Providence Corp., 23/4

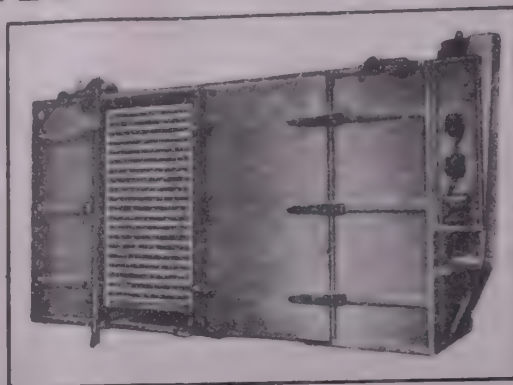
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Resthouse Crescent, Bangalore
 560001. Tel : 5587619.

Sealers India, B-15, Annexe,
 Mugappair Industrial Estate (West),
 Behind Wavin India, Madras
 600050. Tel : 656283/655203. Tlx
 : 24060 PCO-IN-WDT-015.

Swastik Packaging, 4, Dev
 Sadan, Ground Flr., Chimatpada,
 Marol Naka, Andheri (E), Bombay
 400 059. Tel: 8324673/8341340.

SEAMING MACHINES

Ganga Singh Sukhwinder Singh
 & Sons -- See under "Canning Ma-
 chinery & Plants".

SEED CLEANING MACHINERY

Forsberg Agritech (India) Pvt.
 Ltd. -- See under "Grains & Cere-
 als Cleaning / Grading Machin-
 ery".

SELF ADHESIVE TAPES

Maharshi Udyog, 4 Ruchi, 36,
 Swastik Society, Navrangpura,
 Ahmedabad 380009. Tel : 409183,
 425456. Tlx : 0121-6369 GOPI IN.

SEPARATION MACHINERY

Forsberg Agritech (I) Pvt. Ltd.
 -- See under "Grains & Cereals
 Cleaning / Grading Machinery".

John Fowler (India) Limited --
 See under "Gravity Separators".

SHRINK WRAPPING MACHINES

Aarkey Industries -- See under
 "Machinery, Packaging".

Providence Corp. -- See under
 "Sealing Machines".

SIFTERS

Ami Associates & Consultants
 Pvt. Ltd., 13, Manoj Indl. Estate,
 40-A, Katrak Rd., Wadala, Bom-
 bay 400031. Tel: 4133262/4129233
 Fax: 022-413-5638 AC - DR-44.
 Tlx: 011-76330 AMI IN.

United Technologie -- See un-
 der "Conveyor".

SIFTERS, FLOUR

Baker Enterprises -- See under
 "Bakery / Biscuit Equipment".

SIZE REDUCTION EQUIPMENT

Frigmaires Engineers -- See un-
 der "Agitators".

Kaps Engineers, 831, GIDC,
 Makarpura, Vadodara 390 010.
 Telex : 0175 - 533 MICON IN.

SODIUM ALGINATE

Balaji Dye Chem -- See under
 "Additives, Food & Beverage".

Burzin & Leons Agenturen Pvt.
 Ltd., -- See under "Additives, Food
 & Beverage".

Olin Chemicals -- See under
 "Acetic Acid"

Sesu Trading Corp. -- See un-
 der "Acids"

SODIUM BENZOATE

Alok Chem Corporation -- See
 under "Cream of Tartar".

Balaji Dye Chem -- See under
 "Additives, Food & Beverage".

Ganesh Benzoplast Ltd. -- See
 under "Additives, Food & Bever-
 age".

Olin Chemicals -- See under
 "Acetic Acid".

Sesu Trading Corp. -- See under
 "Acids".

SODIUM CITRATE

Olin Chemicals -- See under
 "Acetic Acid"

SOFT DRINK PLANTS

Hitech Ultraviolet Pvt. Ltd. --
 See under "Dairy Plant & Equip-
 ment".

SOFT DRINK CONCENTRATES

Feroze Foods & Flavours -- See
 under "Essences & Flavours".

SORTING MACHINE

Impetus Incorporated, K. 56/4
 Sri Krishna Apts., Annanagar, Ma-
 dras 600102. Tel : 626946. Tlx :
 41-6974 PCO IN.

SOYA FOOD PLANTS

Forsberg Agritech (India) Pvt.
 Ltd. -- See under "Grains & Cere-
 als Cleaning / Grading Machin-
 ery".

Indovita Protein Pvt. Ltd., S-1,
 Bulandshahr Road, Industrial Area,
 Ghaziabad 201 001.

SOYA LECITHIN

Balaji Dye Chem -- See under
 "Additives, Food & Beverage".

Olin Chemicals -- See under

"Acetic Acid"

Sesu Trading Corporation -- See
 under "Acids".

SPECTROPHOTO METERS

Lab Instruments -- See under
 "Heating Mantles".

SPICES CLEANING / GRADING MACHINERY

Forsberg Agritech (India) Pvt.
 Ltd. -- See under "Grains & Cere-
 als Cleaning/Grading Machinery".

STARCH

KMC-Narayan -- See under
 "Potato Starch".

Santosh Industrial Fats. Ltd.,
 7B/37, 10th Fl., Navjivan Society,
 Lamington Rd., Bombay 400 008.
 Tel : 3083283 / 3080510 Fax :
 3080276.

STEAM JACKET KETLE

Gecta Food Engineering -- See
 under "Food Processing Equip-
 ment / Plant".

STERILIZERS

M. F. Marketing Pvt. Ltd. -- See
 under "Pasteurizers".

STICKER LABELLING MACHINE

Maharishi Udyog, 4 Ruchi, 36
 swastik Society, Navrangpura,
 Ahmedabad 380 009. Tel: 409183.
 Fax : 079-425456.

STIRRERS

Cosywo Engineering Co. -- See
 under "Chemical Plants & Equip-
 ment".

Fabdecon Engineers -- See un-
 der "Agitators".

Frigmaires Engineers -- See un-
 der "Agitators".

United Technologie -- See un-
 der "Conveyors".

TANK CLEANING MACHINES / NOZZLES

Siddharth Enterprises, Naren-
 dra Estate, Opp. Kamgar Stadium,
 S. B. Marg, Dadar, Bombay 400
 028. Tel: 4223288, 4224888 Tlx:
 011-71256 Fax : 91 -22-4370388

TARTARIC ACID

Balaji Dye Chem -- See under
 "Additives, Food & Beverage".

Olin Chemicals -- See under
 "Acetic Acid".

Sesu Trading Corp. -- See under
 "Acids".

Thirumalai Chemicals Limited — See under "Acids".

TEMPERATURE CONTROLLER / SCANNER

P. J. Electronics, Unit No. A/
24, 45 Dr. Ambedkar Road, Pune
411001. Tel : 623710.

TEMPERATURE INDICATOR

Sakav Enterprises — See under
"Air Dryers".

THERMOFORMING MACHINES

Pakona Engineers (India) Pvt.
Ltd. -- See under "Machinery, Pack-
aging".

TIN CONTAINERS

Swastik Industries, 34/C
Thakkar Bldg., Gr. Floor, Gala
No-4, Champsai Bhimji Road, Old
Anjirwadi, Mazgaon, Bombay
400010.

TRANSPORT REFRIGERATION

General Airconditioning Co. --
See under "Walk-in Cooler".

Transair -- See under
"Airconditioning/Refrigeration
Plant & Equipment".

TRAVELLING OVENS

Admir Engineers, Plot No. 1E/
4, Shivaji Nagar, Govandi,
Bombay-400 043. Tel : 556 8446/
551 1718/5518182

TRAY DRYERS

Kailash Scientific Co. -- See
under "Dryers, Oven / Tray, etc.".

Sakav Enterprises -- See under
"Air Driers".

TURNKEY PLANTS/ PROJECTS

Fabdecon Engineers -- See under
"Agitators".

Sangram Engineering Pvt. Ltd.,
3/16 Sakal Nagar, Baner Road, Pune
411007. Tel : (0212) 338617 Fax :
(0212) 349673.

UHMWPE ENGG. PLASTIC

Solidur Plastics India Ltd., Post
Box 5, Hyderabad 500 051. Tel :
+91 (842) 623375 Tlx : 0425-6484.

**U. V. WATER
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B. No. 8356, C/14 Grace Plaza, S.

V. Rd., Jogeshwari (W), Bombay
4000102. Tel: 6286845/6282517/
6244574/6244576 Fax: 6206702.

U.V.Tech Systems Pvt. Ltd.,
160/3, Rajani House, Opp. Don
Bosco High School, L.T. Rd.,
Borivali (W), Bombay 400 091.
Tel. : 8013601/8016981 Gr :
ULTRASAFE. Tlx : 011-70151
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ULTRAFILTRATION SYSTEM

Membrane Separation Systems
(Memsep) -- See under "Water
Distillation Plants".

VACUUM EJECTORS

SSP Pvt. Ltd. -- See under
"Evaporators".

VALVES

Flocon Equipments -- See under
"Pumps".

VANILLIN

Amit Fine Chem. -- See under
"Agar Agar (Powder/Strips)".

Kapadia Gumchem Industries -
See under "Guar Gum".

Olin Chemicals -- See under
"Acetic Acid".

Parul Enterprises -- See under
"Agar-Agar (Powder/Strips)".

VARIABLE SPEED DRIVES

Meritt Transmissions -- See
under "Power Transmission Products".

VEGETABLE DEHYDRATION / FREEZING PLANT

Sangram Engineering Pvt. Ltd.
-- See under "Turnkey Plants /
Projects."

VOLUMETRIC LIQUID FILLERS

For-Bro Engineers, 10 Ashok
Indl. Estate, Plot No. 6, Udyog
Nagar, Goregaon (W), Bombay
400062. Tel : 697761.

WALK IN COOLERS

General Air Conditioning
Company, 16/292, Bellassis Rd.,
Bombay 400 008. Tel : 3098635.
Fax : 0091-22-3072833.

WATER DISTILLATION PLANTS

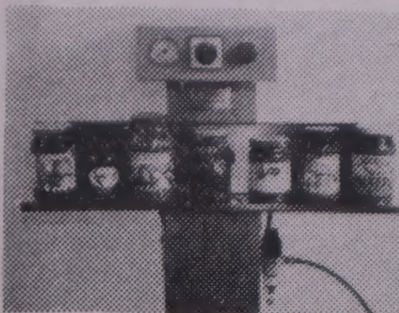
Lab Instruments -- See under
"Heating Mantles".

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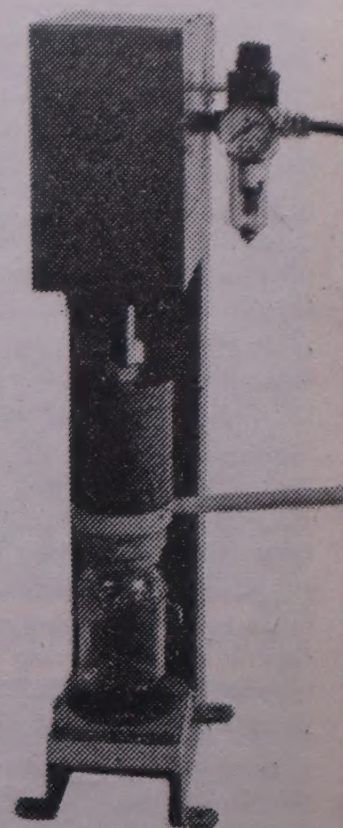
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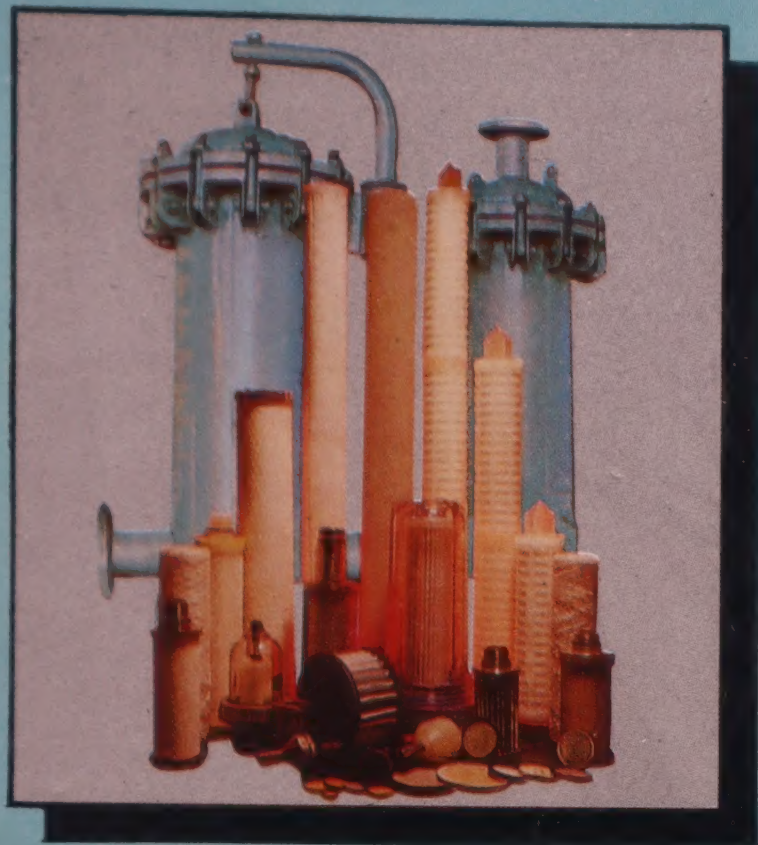
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